Brandeis University

Health Policy Research Consortium

HOSPITAL CLOSURES, OPENINGS, AND MERGERS DURING THE 1980s

Final Report

In cooperation with
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Final Report

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August 1992

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This research was prepared with the support of HCFA Office of Research under HCFA Cooperative Agreement No. 99-C-98526/1-08 to the Health Policy Research Consortium -- Boston University, Brandeis University, Center for Health Economics Research, and Urban Institute. Administrative offices are located at the Heller School, Brandeis University, Waltham, MA 02154. The total cost of this project was $97,728.58 all of which was Federal support. The views and opinions expressed in the report are those of the authors and do not necessarily reflect the opinions of HCFA.

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EXECUTIVE SUMMARY

1.0 INTRODUCTION

The number of closures and the characteristics of closed hospitals were the focus of most of the early studies of hospital closures. Of the multivariate analyses conducted thus far, only the U.S. Government Accounting Office (GAO) has produced a full-fledged analysis. One purpose of this report is to update and extend prior descriptive analyses performed by CHER. One important question that the descriptive analysis addresses is whether the characteristics of closed hospitals have changed over time. Another major purpose of this report is to investigate the causes of hospital closures. Our analysis goes beyond the obvious lack of profitability and loss of inpatients to the factors which caused the loss of patients and, hence, profitability. A simple economic decision model is proposed as the analytic background for the multivariate analysis of hospital closures. In this respect, this report goes beyond the GAO multivariate analysis. This report also presents data on hospital openings and mergers.

2.0 RESULTS OF THE DESCRIPTIVE ANALYSES

CHER tabulated the number of closures of non-federal, short-term, acute- care hospitals for the period 1980-89. A special computer-based file, initially created by CHER, which tracks hospital closures and other changes of hospital status was updated to record changes through 1989. CHER utilized information from the Inspector General of the U.S. Department of Health and Human Services, the American Hospital Association, state licensing boards, and other local agencies to update the number of closures.

The number of closures of non-federal, short-term, acute-care hospitals has steadily increased since the inception of the federal Prospective Payment System (Table ES-1). The average size of hospital that closed was 59 beds. Statistical analysis indicates, however, that it was not until 1986, two years after its implementation, that PPS might have affected the number of hospital closures. The number of additional hospital closures that we estimated to have been influenced by PPS averaged 24 per year over the period 1986 to 1989.

TABLE ES-1

CLOSURES OF NON-FEDERAL, SHORT-TERM ACUTE-CARE HOSPITALS, 1980-89

YEAR	NUMBER OF CLOSED HOSPITALS		
	Total	Rural	Urban
1980	30	9	21
1981	24	15	9
1982	32	12	20
1983	23	10	13
1984	37	16	21
1985	42	19	23
1986	58	32	26
1987	68	35	33
1988	89	47	42
1989	61	37	24
TOTAL	**464**	**232**	**232**

Source: CHER's Universe File.

Between 1980 and 1989, 232 rural hospitals closed while 232 urban hospitals closed. Between 1986 and 1989, however, there were 21 percent more rural hospital closures than urban hospital closures. In addition, for the entire period from 1980 to 1989, rural hospitals were slightly more likely to close that urban hospitals. Sole community hospitals and hospitals with the rural referral center designation were less likely to close than rural hospitals that did not qualify for these designations.

Smaller hospitals, both rural or urban, were more likely to close than larger hospitals. Although there are fewer proprietary hospitals than either voluntary or public hospitals, proprietary hospitals have a disproportionately large share of the hospital closures. This result suggests that because proprietary hospitals must satisfy stockholders, proprietary hospitals are less likely to try stay open in the face of continuing or prospective losses than not-for-profit hospitals.

Hospitals with the highest shares of Medicaid admissions have a disproportionately large share of the hospital closures between 1980 and 1989. While not conclusive, this result suggests that poor people may have reduced access to care because of hospital closures. This possibility is further supported by data that shows that hospital closures occurred in counties with high proportions of poor people.

Like all hospitals, hospitals which closed between 1980 and 1989 experienced declining inpatient volume. Hospitals that closed, however, had larger inpatient volume losses than hospitals which remained open. For the period 1983 through 1988, the Medicare share of admissions for closed hospitals was similar to open hospitals. The Medicare share of admissions, thus, does not appear to be a factor associated with either remaining open or closing.

The inpatient volume declines were greater for hospitals that eventually closed than for hospitals which remained open. Simultaneously, costs per discharge rose faster in hospitals which eventually closed than in hospitals which remained open. And, hospitals which eventually closed usually received higher reimbursement per discharge than hospitals which remained open. However, the cost pressures that seem to be due to declining volume caused profit margins to continuously fall in hospitals which closed. More than half of the hospitals which closed experienced negative profit margins at least one year prior to closure.

More than half of the hospitals which closed between 1985 and 1989 experienced positive profits during the first year of PPS. However, it is well known that hospital profit margins for all hospitals were at record highs during the first two years of PPS. Thus, it would seem that the low volumes prior to PPS experienced by hospitals which eventually closed would have put many of them at risk of closure even if PPS had not been implemented.

3.0 RESULTS OF THE MULTIVARIATE ANALYSIS

A simple hospital closure model was constructed which proposed that hospitals that did not expect to meet a future minimum financial target would close. The data used to test the model consisted of hospitals which closed between 1985 and 1989 (inclusive) and hospitals which remained open from 1980 through 1989. A multivariate probit regression was used to test the model.

The regression results indicated that smaller hospitals are more likely to close than larger hospitals. Public and private not-for-profit hospitals are less likely to close than proprietary hospitals. Hospitals affiliated with hospital systems (chains) are less likely to close. Hospitals with a high degree of financial leverage are more likely to close. The shares of inpatient discharges covered by Medicare or Medicaid does not affect the likelihood of closure.

The last mentioned results are in conflict with the findings contained in a GAO report which found that Medicare and Medicaid shares of inpatient days affected closure: a low Medicare share increased the probability of closure and a high Medicaid share increased the likelihood of closure. One possible problem with the GAO's specification is the use of an endogenous variable, occupancy rate, as a regressor in its logit regression.

Most of the results of the multivariate analysis supports the findings of the descriptive analyses. However, there are two notable differences. The descriptive analysis indicated that rural hospitals were slightly more likely to close than urban hospitals and that hospitals with high shares of Medicaid admissions were more at risk of closure than hospitals with lower Medicaid shares. The multivariate analysis indicates that a hospital in a rural area, ceteris paribus, is no more likely to close than an urban hospital. The bedsize effect, however, may be picking up some of the rural effects. The multivariate analysis also indicates that the share of Medicaid admissions does not affect the likelihood of closure.

One problem with the data is inescapable: there were relatively few hospital closures as compared to the overall population of hospitals between 1985 and 1989. Only with more years of data can definite conclusions about the results be established. Some factors that may affect a hospital's likelihood of closure may be difficult to measure or obtain. Evidence, obtained in CHER interviews with hospital executives, suggests that hospitals with significantly older physician staffs are at higher risk of closure. Other factors which could affect the probability of closure include the proximity of competing hospitals (especially in urban areas), and the relative attractiveness of competing hospitals.

HOSPITAL CLOSURES, OPENINGS, AND MERGERS DURING THE 1980s

1.0 INTRODUCTION

An important long-standing goal of public policy has been the promotion of access to hospital inpatient care. The purpose of the Hill-Burton Act (1946) was to provide federal grants to help construct hospitals in areas of the greatest need (often rural areas). The mere presence of hospitals, however, was not sufficient to ensure that prospective patients actually obtained inpatient care. Financial barriers to access faced by the elderly, often due to the lack of health insurance, was a major problem that helped lead to the creation of the Medicare and Medicaid programs with the objective of helping increase the access to hospital inpatient services for the elderly and poor (Anderson, 1975).

Subsequent to the enactment of the Medicare and Medicaid programs, both public and private expenditures on health services, especially inpatient care, rose dramatically. This, in turn, stimulated research into hospital behavior and the causes of increasing cost and utilization of health services. During this period, mid-1960s to early 1980s, there was little attention paid to hospital closures by either public policy makers or researchers.

In recent years, there has been increased interest in hospital closures. The United States Government Accounting Office (GAO) produced two reports in June 1990 on the closure of hospitals, especially rural hospitals. The GAO (1991) also did a study on how hospital closures might affect access in rural areas. The Inspector General (IG) of the U.S. Department of Health and Human Services (DHHS) conducted surveys of the number of hospital closures in 1987, 1988, and 1989 (IG, 1989, 1990, and 1991) and analyzed the impact of closures on access. The American Hospital Association (AHA) now produces an annual list of closures of registered hospitals in the United States and its overseas possessions. The Center for Health Economics Research (CHER) and Health Economics Research, Inc. (HER) has constructed a file to track changes in the status of short-term acute-care hospitals and have conducted research on changes in hospital status (Hendricks et al., 1988, 1989) for HCFA. Hadley (1989) conducted a study on hospital closures under a contract from the Prospective

Payment Assessment Commission (ProPAC). AHA researchers (Samuels, et al., 1990 and Mullner, et al., 1990) have conducted partial multivariate analyses of hospital closures.

The apparent stimulus to the interest in hospital closures was the implementation of the federal Prospective Payment System (PPS). The fixed PPS payments puts hospitals at risk for the Medicare beneficiaries that they treat. Hospitals whose costs for treating Medicare beneficiaries exceed Medicare reimbursement bear the brunt of the financial loss. Although hospitals closed prior to PPS, the rate of hospital closures has increased since PPS was implemented. In turn, the increase in the number of hospital closures may affect access to care. Thus, it is possible that the previous efforts of the federal government to increase the access to care may be partially undone by the recent wave of hospital closures.

The number of closures and the characteristics of closed hospitals were the focus of most of the early (descriptive) studies. Of the multivariate analyses conducted thus far, only the GAO has produced a full-fledged analysis. One purpose of this report is to update and extend prior descriptive analyses performed by HER (1988) and CHER (1989).* One important question that the descriptive analysis addresses is whether the characteristics of closed hospitals have changed over time. For instance, has the relative number of hospital closures that are rural increased? Or, are larger hospitals now closing? Another major purpose of this report is to investigate the causes of hospital closures. Our analysis goes beyond the obvious lack of profitability and loss of inpatients to the factors which caused the loss of patients and, hence, profitability. A simple economic decision model is proposed as the analytic background for the multivariate analysis of hospital closures. In this respect, this report goes beyond the GAO multivariate analysis and the partial multivariate analyses conducted by AHA researchers.**

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*The current report is a revision and extension of a HER report (Adamache and Hurdle, 1991) submitted to HCFA during June 1991.

**In addition, Margo Rosenbach and Debra Dayhoff of CHER are conducting an analysis of the impact of hospital closures on access under a separate HCFA grant.

Chapter 2 describes the construction and updating of the database CHER uses to track closures of short-term, acute-care hospitals. It also describes the definitions CHER employs to define short-term, acute-care hospitals; closures; openings; mergers; and other changes of status. Chapter 3 presents the number of closures, openings, and mergers for the period 1980 through 1989. Our counts of closures are compared with other reports. The results of statistical tests of whether and when PPS started affecting the number of closures are presented.

Chapter 4 describes the characteristics of hospitals that closed and compares them to the characteristics of hospitals which remained open during the entire analysis period. The characteristics of counties in which hospitals closed are also presented. Finally, the changes in total and Medicare inpatient utilization are described and are compared to hospitals which remained open. Chapter 5 discusses, for both closed hospitals and those which remained open, the average cost per admission for both all inpatients and Medicare beneficiaries and how they changed after the introduction of PPS. Similarly, the average revenue per admission, Medicare inpatient margin, and overall patient margin for both closed and open hospitals are analyzed.

Chapter 6 investigates the causes of hospital closures. To motivate the analysis, a simple economic decision-making model is proposed. The model is tested using a multivariate framework. Although many of the independent variables in the probit regression are similar to those used by the GAO, as noted above, the analysis in this report is explicitly motivated by an economic model of decision-making whereas the GAO does not propose an economic model.

2.0 DEFINITIONS AND DATA

2.1 Definitional Issues

There are several ways to define a short-term, acute-care hospital and the closure, reopening, merging and demerging of such hospitals. Definitional differences account for differences in the numbers of closures and mergers among various reports. For this reason, the terms "short-term acute care hospital," "closure," and "merger" must be precisely defined.

2.1.1 Defining Short-term Acute-care Hospitals

In this report, short-term acute care is defined as care for an average of less than 30 days per stay for general medical and surgical services or specialty services that include obstetrics and gynecology; eye, ear, nose and throat; orthopedic; arthritis; proctology; geriatrics; etc. Hospitals not defined as short-term, acute-care hospitals (i.e., hospitals exempt from PPS's DRG payment system) include psychiatric institutions, alcohol and chemical dependency facilities, tuberculosis and other respiratory disease hospitals, rehabilitation hospitals, children's hospitals, mental retardation facilities, and chronic disease hospitals. Acute-care facilities not available to the general public are also excluded from the file (i.e., prison hospitals, psychiatric hospitals, or school hospitals), although some facilities limiting care to specific age groups (i.e., over-65) are included.

2.1.2 Defining a Hospital Closure

Among the events that may be given as a hospital's closure date are 1) its last day of Medicare certification, 2) the date admissions stopped, and 3) the date the license was revoked. These dates may be the same in some cases, but can differ by a few days or by more than a year in other cases depending on legal or logistical problems. From an analytical point of view, the date admissions ceased is the most relevant. However, since the licensing board is often the only source of information on hospital closures (particularly in the earlier study years), we were forced to go with the best information that they had, and sometimes that was

simply the date the license was surrendered. In the majority of cases, this corresponds to the date admissions stopped, at least within a few days. In some cases when this didn't hold true, the licensing boards had both the date the license was surrendered and the date admissions stopped. In these cases, we used the date admissions stopped. Still, in cases when the licensing board was unaware of the discrepancy between admission cessation and license surrender, the date they provided is a biased estimate for our purposes and such bias does exist in our data.

In some cases a hospital closed but re-opened shortly thereafter (often under new management). If the reopening was in the same calendar year, the closure and reopening were not flagged. However, if the closure extended past the end of the calendar year, this was reflected in the Universe File as a closure in one year and an (re-)opening in another year. The reason for this rule was to avoid double-counting beds and overstating the hospital capacity in that locale for that particular calendar year.

Beginning with 1987 closures, the Inspector General (IG) of the U. S. Department of Health and Human Services annually tabulates hospital closures. The IG also counts as closures instances in which a hospital no longer offers general short-term, acute-care services and, instead, provides only specialized inpatient services. For instance, if a hospital converted from providing general short-term, acute-care services to providing only psychiatric services, the IG counts this event as a hospital closure. CHER, however, records this event as a miscellaneous change of status instead of a closure. In this respect, CHER and the American Hospital Association (AHA) treat such events in a similar fashion.

Individual facilities that are closed subsequent to a hospital merger (defined in the next section) are counted by the IG as a closure. At the present time, CHER does not count such events as a closure. CHER, instead, records the reduction of hospital short-term inpatient beds of such events. There are two major reasons for CHER's past process for handling such events. First, the initial creation of CHER's data base, described in section 2.2., was an enormously complex task. Project deadlines did not allow the time necessary to resolve all of the problems arising from hospital mergers. Second, some facilities which eventually closed after a merger, did so several years after the merger. However, as a result of the merger, the facility no longer had a separate AHA hospital ID. Thus, it was difficult to track individual

facilities with the existing computer data bases. Large drops in the number of short-term hospital beds was the easiest way to detect such facility closures. CHER, as a matter of policy, is reviewing new methods for recording the closure of facilities subsequent to a merger. One consideration in adopting a new method is how far back in time should previously recorded mergers be reviewed in order to construct a consistent time series.

2.1.3 Defining Mergers

Of all events involving a change in hospital status, the most difficult to define is a hospital merger. The main problem is that there is no commonly accepted definition of a merger. Another problem is that there is inconsistent usage of the term. One common definition of a merger is the integration of personnel and services at the department level (for example, medical records or nursing services). For our purposes, this definition is inadequate.

From a theoretical viewpoint, we wish to record as a merger any event in which two or more hospitals, in the same market,* which previously acted independently of each other, combine one or more aspects of hospital operations. For instance, if two hospitals maintain separate facilities and separate management styles at the facility level but are under the common strategic direction or custodianship of a central authority, then we consider this a merger. Further, from our viewpoint, it does not matter whether one hospital purchased the other hospital. It also does not matter whether one hospital is the "dominant" partner. The important issue from our viewpoint (and by economists), is the loss of complete independence. Thus, if the Hospital Corporation of America (HCA) were to acquire another hospital in, say, Richmond, Virginia, we would regard that event as a merger since HCA already has several hospitals in Richmond. Note, however, we only consider those combinations of hospitals which were already present in a market. For instance, if HCA were to acquire a hospital in a city in which HCA did not have a prior presence, then we would not consider the acquisition as a merger.

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*For urban hospitals, the market is the MSA in which they are located. For rural hospitals, the market is the county in which they are located.

It is very difficult, however, to identify hospital mergers as we define them. Indeed, because there is no commonly accepted industry usage of the term, it is difficult to obtain the requisite information even when our definition of a merger is explained to a hospital or state licensing board.

Using the American Hospital Association's (AHA's) definition of a merger has the advantage that the mergers are always in close proximity to each other (always in the same state and almost always the same county). However, the AHA lists all mergers in which hospitals cease to report separately. More importantly, the AHA set of mergers exclude merged hospitals which continue to report separately, some of which change market competition substantially. While our definition of merger includes such hospitals, in practice we could generally only include them when state licensing boards kept track of such information and passed it along to us. Similarly, without calling the hospitals ourselves, it was not possible to determine which of the AHA designated mergers resulted in the shut down of one facility, except implicitly through bedsize. For this update, an effort was made to obtain this type of information (see section 2.2.3).

Instances where affiliations or combinations between hospitals have not been flagged as mergers include: (1) where a hospital became a member of a multihospital system but had not otherwise been involved in merger activity; (2) other affiliations and links between hospitals which are not known to us but which might affect the competitive environment (including many mergers or acquisitions in the same area in which the hospitals continue to report separately).

CHER is attempting to devise new methods to record mergers that reflect CHER's preferred definition of a hospital merger. However, in the meantime, tabulations of hospital mergers should be regarded with caution.

2.1.4 Defining Demergers

A demerger is the reverse of a merger. As such, a demerger is the splitting of a merged entity into two or more independent hospitals. As in the case of mergers we distinguish between demergers in local hospital markets and system-related changes: Demergers of local

hospitals are more likely to affect competition, or the potential for competition than hospitals leaving a hospital system. Also, as with mergers, it is possible that changes are occurring for which we have no information, such as changes in referral arrangements. Very few demergers were identified.

2.2 Data

2.2.1 Data Sources and File Creation

The chief data source for this report was the CHER Universe file, which contains records of all non-federal, short-term, acute-care hospitals in existence any time between 1980 and 1989. The original database combined records for 1980-85 from the AHA Annual Surveys, Medicare Cost Reports (HCRIS), and HCFA's Provider of Service (POS) File. The file was updated with AHA Annual Surveys for 1986, 1987, 1988, and now 1989. Separate files on closed hospitals produced by the AHA, the University of Illinois' Center for Health Studies, and the Office of the Inspector General of DHHS were used to determine hospital status changes. Discrepancies were resolved by telephone calls to the appropriate state agencies.

For this report, data from the AHA and the Inspector General were again used to determine changes, and in addition, letters were sent to 48 state licensing boards to confirm status changes over the entire 1980-89 study period. To resolve differences in information among these sources with respect to openings and mergers, we sometimes called the hospitals themselves. For closures, we generally had to use the licensing board as the final authority. In the majority of cases, the date the operating license is surrendered is the date that the hospital closed its doors. However, in a few cases the license is surrendered some time after the doors close in hopes that the hospital can be reopened without repeating the certification process. When the licensing board was aware of such discrepancies, they provided us with the actual closure date, but in cases when they were not aware of an earlier closure, the dates we show may not reflect the actual closure date.

To create the Universe file, all facilities that were exempt (e.g., nursing homes, chemical dependency units, psychiatric facilities and federal facilities) for the entire 1980-89 period were

removed from the file. Hospitals which changed from acute care hospitals to an exempt unit (or vice-versa) were left on the file, but show a change of service in the relevant year. For each hospital record on the file, the following information was retained: the AHA hospid; the hospital's name and location; the year and source of the record; AHA ownership and service codes; POS facility codes; various utilization, personnel and expense data; Medicare participation data; information on affiliations; and three estimates of the hospital's bedsize (one from each source). In addition demographic information on county population and other area characteristics was merged onto the file from the Area Resource File (ARF).

2.2.2 Data Problems

Creating the universe file described above did present some problems, mainly because all these data were not always available for each hospital, or because the information was not consistently reported in all years. Some hospitals did not have records for all the years 1980-89. They could have opened or closed during that period or the data could simply be missing. Other hospitals lacked identification numbers, because they changed names or merged. Occasionally a hospital had two records for the same year. In this section we describe the various data problems in detail and discuss how they were resolved.

No Hospid

On the original file constructed for the 1980-85 period, there were originally 2,662 records without AHA hospital identification numbers. Each record was assigned a sequence number for identification. These records were manually matched by name, FIPS county code, and bedsize with records in the same state that had an identification code. We were also able to assign a few hospital identification numbers from an internal CHER file which listed hospitals by state and hospid. Some hospitals could not be matched because of name changes. These were resolved using two types of sources: the AHA guides (1978, 1982, 1984, and 1986-1990) and the provider of service (POS) file from HCFA.

Through these methods, we were able to assign identification codes to 2,028 records that had been missing them. An additional five records were United States service hospitals and were placed on the federal file. The 629 records that still lacked hospital identification numbers were given internal CHER reference numbers. After extensive telephone searches, all but seven of these internal hospital identification numbers have been identified.

Exempt Units

Some hospitals had more than one record for a single year and to resolve this problem, the hospitals were contacted by telephone. In the majority of cases the excess records represented exempt units of acute-care facilities. The exempt records were subsequently deleted from the universe file.

Some of the AHA-designated mergers and demergers pertained only to the exempt units of acute-care hospitals. We did not want to include records of these structural changes within our merger file, because they did not affect the acute-care beds of the parent hospital. Yet, because a structural change had occurred, the AHA had given the acute-care hospital a new hospid, making two hospital identification numbers for one hospital during 1980-1989. To simplify the records of the hospitals with two hospital identification numbers, we deleted the least frequent of the two hospital identification numbers and assigned an "x" in the last position of the most frequent hospital identification code (e.g., 99999X).

Missing AHA Data

Compiling a complete computer file of acute-care, general hospitals was only the first step in the construction of the analytic file. Equally important was ensuring complete data for the 1980 through 1989 period. Some hospitals were missing important information for a few items (e.g., location); others lacked all AHA information for one or more years.

The first step in resolving missing data problems was to determine which hospitals lacked information because they were mergers, closures, openings, reopenings or demergers. Then, for those hospitals not identified as having structural changes, the missing information was filled with another source (e.g. the POS file or a telephone call to the hospital or licensing board). Alternatively, another available year of AHA data was used to pad the missing years,

based on the assumption that most of the crucial variables (such as control, service, and beds) do not change significantly from year to year.

To check for structural changes, we began with AHA lists of closure, demerger, and merger information published each year for the year just ended, which allowed us to identify the majority of closures, mergers, or demergers. In addition to the AHA list of closures, we had an internal closure file from the PPS-1 file sent to us by ABT Associates in 1987 for checking missing data in the 1980-86 study period. Abt data were also used to identify some merged hospitals. Information from other sources such as the Inspector General were also used to identify structural changes. Finally, nearly all hospital licensing agencies in the 48 contiguous states were contacted prior to this report to verify all the closures and mergers documented on the Universe file between 1980 and 1989 and they were asked to inform of us of any we were missing.

If the relatively few new closures or mergers provided by the licensing boards did in fact involve short-term, acute-care hospitals, the information was added to the file. In addition, all mergers listed in the AHA general survey documentation were verified by contacting the dominant surviving hospital. In the process of verifying the mergers, we found that some could not be considered mergers by our definition and that others occurred far earlier than AHA data indicated. In these cases, we used the information provided by the hospital administrators.

Missing information that could not be explained by structural changes had to be replaced based on information from other sources or other years of AHA data. Missing data for one or more years in the 1983-89 period was replaced based on the information in the closest available year. For example, if data were missing 1984 and 1985, but the state licensing boards indicated no temporary closure, we assumed the hospital had also been open during the intervening years and padded the missing records with information from 1986.

Hospitals that were complete except for 1980, 1981, or 1982 were checked against the AHA guides to see if they had been open prior to 1980. If the 1978 AHA guide showed that they were in business, and the licensing boards did not contradict this information, we padded any years that were missing with information from the first year we had on file. The hospitals that were not listed in the AHA guides for the years in question were checked against the POS

file to find their effective date for Medicare coverage. When the effective date was prior to the period in question, we assumed the hospital had been open, and we padded the missing years with information from the first available year on the file.

2.2.3 Verifying Data Accuracy

Structural Changes

Sometimes after a merger, hospitals might continue to report separately. To address this problem, we verified that we had the proper years of records for the hospitals going into a merger, and that the sum of the beds of the hospitals going into a merger were roughly equivalent to the beds listed in the first year of the merger result. (Merging hospitals can choose to close beds to rationalize costs or diversify into non-acute care.) If any of the merging hospitals were listed with records in years after the merger had occurred, we deleted the excess record or records. When the sum of the hospital beds of hospitals going into a merger was not similar to the bedsize of the merger result record, we referred to the AHA guides and our past records to reconcile the differences. In a few cases we made a special designation of A and B for a hospital that was reported by HCFA to be two distinct entities, whereas the AHA reported it as one facility with one hospid.

Because the joint reporting of AHA-designated merged entities was sometimes spotty, we verified all the mergers they listed by calling the hospitals themselves. These calls confirmed that quite often, significant organizational changes did occur in hospitals identified by the AHA as merged. However, these changes often occurred much earlier than AHA documents, so that in fact some of the merger dates we show, particularly pre-1987, simply reflect the date of joint reporting rather than the actual date of the more salient organizational changes.

A few times the AHA designated two hospitals as having merged when they were really just part of the same hospital system. In a few of these instances we had records for both the hospital and the system. We chose to delete the system records and keep the independent hospital sequences.

Bedsize Variables

Another problem we encountered on the universe file was that some of the bedsize numbers for the hospitals were questionable. As previously mentioned, we had three sources of bed size information: POS, HCRIS, and the AHA. Unfortunately, the POS's definition of a bed differs from the definition used by the AHA and HCRIS. The POS bed numbers reflect licensed beds and HCRIS's and the AHA's bed numbers represent staffed beds. Therefore, we constructed two variables, one for licensed beds and one for staffed beds. Though we had more complete information for licensed beds, we gave staffed beds priority in terms of defining bedsize. The reason for this choice is that staffed beds are a much more accurate indicator of the true bedsize of hospitals. Only when a hospital record lacked both HCRIS and AHA bed information did we rely on the POS licensed bed numbers.

To check potential discrepancies in bedsizes for individual hospitals throughout the 1980-1989 period, we created two lists from the universe file. The second list contained any hospitals where the source had changed at least once, and the bedsize had increased or decreased.

For both lists the hospital bed numbers were compared to those listed in the AHA guides (1978, 1982, 1984, and 1986-1990). If the fluctuations in bed numbers listed in the file paralleled fluctuations noted in the AHA, the bed numbers were left unchanged. If the bed number sequences listed on the file differed greatly from the AHA bed number sequences, we made an assumption about which numbers were more accurate, or we phoned the state licensing agencies to clarify which numbers were more correct. In a few instances, the hospitals were found to be exempt throughout the period in question.

3.0 HOSPITAL CLOSURES, OPENINGS, AND MERGERS 1980-89

In this chapter, the numbers of closing and opening hospitals during the 1980-89 period are presented along with the resulting bed losses and gains. As noted in Section 2.1, the way in which a hospital and a closure is defined will affect these numbers, sometimes making them different from other reports. This report is concerned only with general, short-term acute care hospitals. The number of closures presented in this report reflects the number of general hospitals ceasing to provide any care. General hospitals converting to psychiatric hospitals or chemical dependency facilities are not considered closures since short-term acute care is still provided. Instead, hospitals are categorized as having a change of service, and are not included in this report. Also, hospitals that reopen (under the same license) are not considered closures and are excluded from this report.

3.1 Hospital Closures

Table 3-1 shows the number of short-term acute care hospitals that closed in the 48 contiguous states over the 1980-89 period. The number of beds lost as a result of these closures are also shown in the last column. A total of 464 hospitals closed during this period resulting in the loss of 27,155 beds. On average, 59 beds were eliminated each time a hospital closed, suggesting that closures occurred disproportionately among small hospitals. (Appendix A lists hospitals that closed during 1989.)

The number of hospital closures fluctuated between 23 and 31 between 1980 and 1983. The number of closures then increased continuously from 1984 to 1988 - reaching a high of 89 closures. The increase in closures is most noticeable starting in 1986. Despite many predictions of increasingly more closures (see Burda, 1991), the number of closures fell to 61 in 1989. Combined with preliminary American Hospital Association (AHA) data (see Burda, 1991) that indicates there were 50 hospital closures in 1990, the data suggest that the upward surge in hospital closures has, at least temporarily, ended.

TABLE 3-1

CLOSURES OF NON-FEDERAL, SHORT-TERM ACUTE-CARE HOSPITALS, 1980-89

YEAR	NUMBER OF CLOSED HOSPITALS			NUMBER OF BEDS LOST DUE TO CLOSURES		
	Total	Rural	Urban	Total	Rural	Urban
1980	30	9	21	2,386	500	1,886
1981	24	15	9	1,627	395	1,232
1982	32	12	20	1,482	462	1,020
1983	23	10	13	1,542	279	1,263
1984	37	16	21	1,513	450	1,063
1985	42	19	23	2,858	619	2,239
1986	58	32	26	2,829	1,044	1,785
1987	68	35	33	4,061	1,355	2,706
1988	89	47	42	5,527	1,921	3,606
1989	61	37	24	3,330	1,444	1,886
TOTAL	**464**	**232**	**232**	**27,155**	**8,469**	**18,686**

Source: CHER's Universe File.

3.2 Hospital Openings

The number of short-term acute care hospital openings during the 1980-89 period does little to offset closures. Only 121 hospitals opened during this time (Table 3-2). While opening hospitals tend to be larger on average (92 beds per opening versus 59 per closure), only 11,126 total beds were added over the 1980-89 period, less than half the number that closed.

In addition, as hospital closures steadily increased during the post-PPS period, hospital openings declined. In the immediate years following PPS, the effect is negligible, as would be expected since the decision to open a hospital is presumably made at least 2 or 3 years before the actual opening. However, by 1986, hospital openings seem to have fallen to about half of what they were in the early and mid-eighties with only 10 opening in 1986 and only 8 opening in 1989.

Judging by these statistics, it appears that since PPS, closures have increased and openings decreased, suggesting a decrease in access to hospital care. However, as past work has shown, many of these closures were in failing, under-utilized hospitals and in areas with decreasing population. Also, while the trend toward centralization of hospital services may curtail access to certain types of basic care, particularly in rural areas, it may also increase access to higher quality and to more diverse types of care. In the following chapters, we examine more closely where closures are occurring, and in what types of hospitals to better show the effect of hospital closures.

3.3 Intramarket Hospital Mergers

The number of mergers during the 1980s between two or more general, acute-care, short-term hospitals in the same market are shown in Table 3-3. There were a total of 129 intramarket hospital mergers during the 1980s with a peak of 31 mergers during 1988. While there are erratic year-to-year changes in the number of mergers, it is clear from Table 3-3 that the annual number of mergers is higher during the period following 1984 (implementation of PPS) than in the pre-PPS period. It is, however, quite likely that the number of intramarket mergers shown in Table 3-3 is less than the number of intramarket mergers that actually

TABLE 3-2

OPENINGS OF NON-FEDERAL, SHORT-TERM ACUTE-CARE HOSPITALS, 1980-89

YEAR	NUMBER OF OPENED HOSPITALS			NUMBER OF BEDS GAINED DUE TO OPENING		
	Total	Rural	Urban	Total	Rural	Urban
1980	2	1	1	213	9	204
1981	17	3	14	1,695	99	1,596
1982	9	1	8	1,149	56	1,093
1983	19	1	18	1,357	22	1,335
1984	19	2	17	1,586	72	1,514
1985	19	1	18	2,063	25	2,038
1986	10	1	9	1,350	50	1,300
1987	14	1	13	1,005	109	896
1988	11	2	9	653	53	600
1989	1	0	1	55	0	55
TOTAL	**121**	**13**	**108**	**11,126**	**495**	**10,631**

Source: CHER's Universe File.

TABLE 3-3

MERGERS BETWEEN NON-FEDERAL, SHORT-TERM ACUTE-CARE HOSPITALS WITHIN THE SAME MARKET, 1981-89

	Number of Mergers			Number of Participating Hospitals			Number of Short-Term Acute-Care Beds Involved		
Year	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
1981	14	5	9	28	12	19	6,249	1,083	5,166
1982	5	3	2	10	4	4	1,112	587	525
1983	13	2	11	26	4	28	6,898	335	6,563
1984	8	2	6	17	4	19	2,903	359	2,544
1985	12	6	6	24	12	12	5,164	1,357	3,807
1986	14	2	12	29	4	29	6,044	211	5,833
1987	20	6	14	40	12	28	9,903	1,415	8,488
1988	31	11	20	62	23	40	12,281	2,678	9,603
1989	12	2	10	24	4	20	4,346	341	4,005
Totals	129	39	90	261	79	182	54,900	8,366	46,534

Source: CHER's Universe File.

occurred. The reason is that acquisitions by hospital systems (chains) in markets in which they already have a presence are often not identified as mergers by state licensing boards or the AHA. Whereas CHER, however (see Chapter 2), classifies such acquisitions as mergers because of the potential competitive effect on the behavior of hospitals in the market. Because the number of intramarket acquisitions is difficult to determine, especially for the period prior to 1985, definitive statements about merger trends cannot be made. Thus, while Table 3-3 shows that the annual number of intramarket mergers increased after the implementation of PPS, it is possible that converse may be true. For instance, during 1987, HCA partially divested itself of a large number of hospitals. It is quite possible that HCA also ceased making new acquisitions in markets where it retained a market presence.

Accepting, at least in absence of better information, that the annual number of mergers increased after PPS, what effect did PPS have on hospital mergers? Hospitals executives interviewed during the course of six site visits of merged conducted by CHER (Cromwell and Adamache, 1991) indicate PPS did have an effect. In some instances, PPS merely hastened the merger by one or two years. In other cases, the hospitals probably would not have merged if PPS had not been implemented.

3.4 Comparison with Other Reports and Studies

3.4.1 Comparison with Past HER and CHER Reports

Annual closure numbers differ between this report and previous HER (Hendricks, Cromwell, et al., 1988) and CHER (Hendricks, et al., 1989) reports because as we collect more information over the years, the accuracy improves. In this last update effort, information from the state licensing boards allowed us to correct many closure dates. Comparing information from the licensing boards with AHA information showed that in many cases, closures occurred earlier than the AHA reported, and sometimes later. Calls to hospitals showed the same for hospital openings. Sometimes, hospitals were not able to open on the scheduled date that AHA reported. In addition, we found that some closed hospitals subsequently reopened under the same license and created a separate category for these types of closures. Finally,

calls to hospitals verifying AHA-reported merger dates revealed the largest number of discrepancies between reported and actual dates. These calls also allowed us to explicitly track subsequent closures of merged facilities, rather than implicitly showing them in terms of lost beds.

3.4.2 Comparison with the DHHS Inspector General's Report on Hospital Closures For 1989

Discrepancies in annual numbers of hospital closures among various reports stem in part from differences in definitions of hospitals and closures and in part from delays in AHA reporting of closures. For example, the Inspector General includes as a closure hospitals that change service to, say, a chemical dependency facility or psychiatric facility. The IG also counts as closures hospitals that the IG knows have re-opened. CHER, on the other hand, does not count changes of service and known subsequent re-openings as part of its permanent closures. For all these reasons, we would expect the IG to show higher numbers of closures than CHER in any one year. On the other hand, they do not seem to catch all hospital closures, either because some may not fit HCFA's definition of short-term acute care, or because they simply do not have as complete of a list of such hospitals as the AHA. In addition, for any given year of hospital closures, CHER contacts licensing boards and other local planning agencies six to nine months after the IG. During the interim period, these state and local agencies often obtain more and better information about hospital closures, which, in turn, allows CHER to collect more up-to-date information than the IG or the AHA. For these reasons as well as definitional differences regarding the date of closure (e.g., date of license surrender vs. cessation of admissions) our numbers are different from those shown by the IG, but they are not always smaller in spite of our omission of one-site closures of merged hospitals.

The latest IG report (1991) listed 76 closures of general, acute-care hospitals during 1989 - 15 more than CHER. The IG report (1991) also indicated that three of the hospitals re-opened and six hospitals had converted to a specialty treatment facility. In Appendix B, individual discrepancies between the IG and CHER are discussed. In the first part of Appendix B, we discuss the reason, for each of those hospitals that the IG indicated as

closing, why we did not also count the hospital as closing. In the second part of Appendix B, we list those hospitals which we considered closed that the IG did not count as closed and the possible reason why the IG did not do so.

3.5 The Impact of PPS on Hospital Closures

The high number of hospital closures subsequent to the introduction of PPS raises many questions. Two questions are discussed here. First, did PPS lead to an increased frequency of hospital closures? If so, when did hospital closures start increasing in response to PPS's fixed reimbursement rates and the admissions review process?

Detecting whether PPS had an impact on closures is not an inconsequential task. To statistically detect a break or change in the trend requires a sufficient number of observations (years) on hospital closures before and after PPS was implemented. The "pre" period consists of only four years (1980-83), and the "post" period has only six years (1984-89). The total number of available observations, ten, is very low. Thus, the number of degrees of freedom available to statistically detect an impact is correspondingly low.

In addition to the mechanical problem due to a low number of degrees of freedom, there are two potentially confounding factors. First, when is it reasonable to expect PPS to have an impact on hospital closures? It is not likely that a hospital closure is the result of a sudden loss of volume or profits. Rather it is more likely that hospitals which close experience several years of volume and/or financial difficulties before closing. Thus, it is quite likely that most, if not all, of the hospitals that closed in 1984 would have closed even if PPS had not been implemented. What about closures during 1985? PPS had been in effect only one year. Is it likely that one year of PPS experience had a dramatic effect on the number of hospital closures especially when the hospital industry, as a whole, earned record profits (net earnings) in 1984? Further, PPS did not shift to fully national rates until the late 1980s and capital costs still were being reimbursed on a hospital's own capital costs. Thus, it is quite possible that PPS may not have been responsible for many of "additional" closures that occurred in 1985.

Complicating the analysis, however, is the possibility that PPS may have hastened the closure of a few hospitals. For instance, "observation" admissions in rural areas were no longer permitted (reimbursable) under PPS. And many older physicians (mostly in rural areas?) could not or would not change their practice patterns and retired early rather than change. Some hospitals may have been affected by the sudden retirement of one of the few local physicians and were unable to recruit a replacement. Thus, it is possible, in some circumstances, that PPS may have hastened the closure of some hospitals by one or more years.

In order to detect a PPS effect on the trend of closures the following two equations were estimated:

CLOSURES = a + b*TIME + c*PPS.

CLOSURES = a + b*TIME + c*(TIME*PPS).

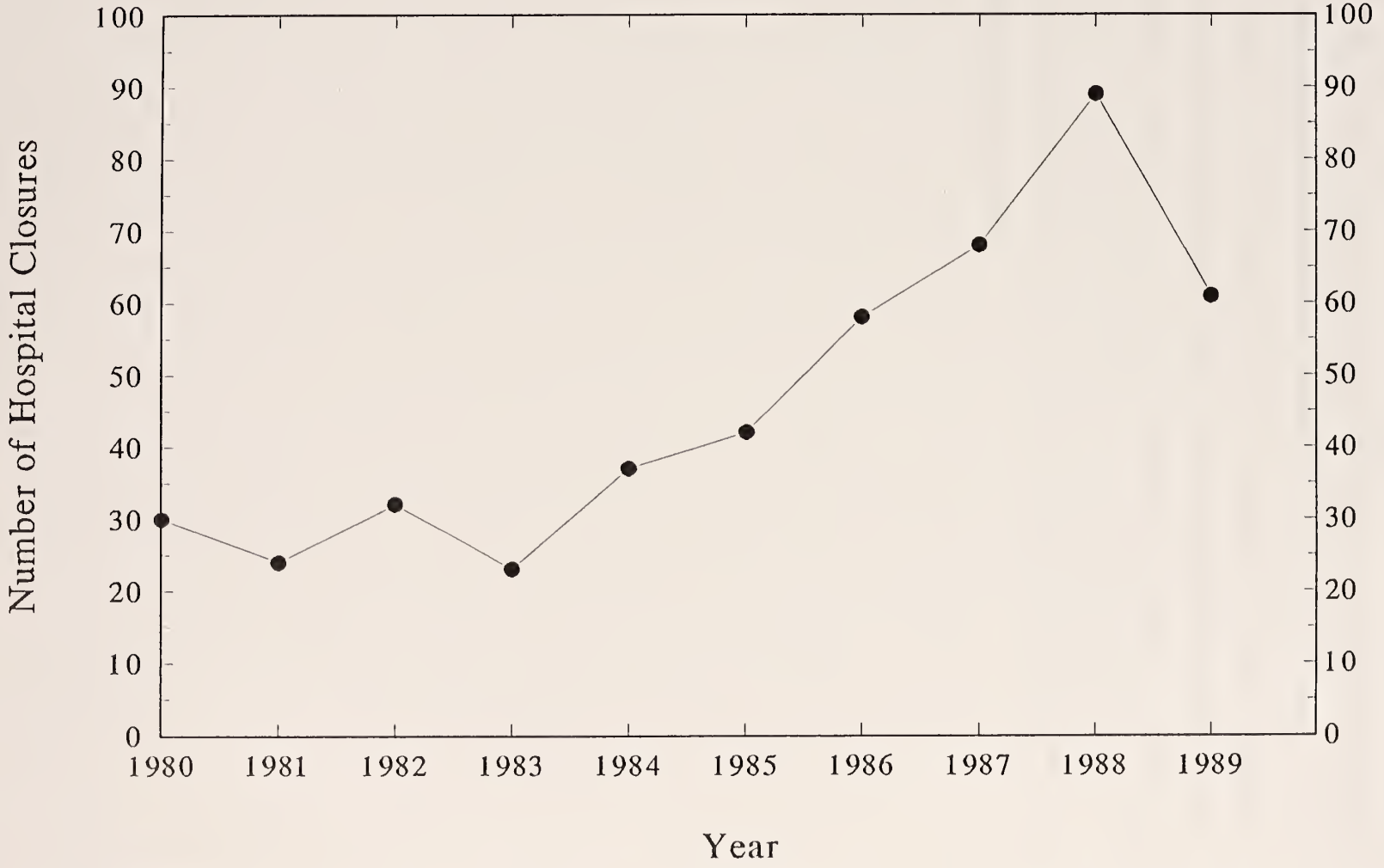
Time is a sequential variable running from zero to eight. PPS is a 0,1 binary variable with 1s indicating the years PPS was in effect. Instead of PPS being entered by itself in the second equation, it is interacted with the time trend variable. The interaction term should detect both a shift in the intercept of the time trend and a change in the slope of the trend.

Since PPS might not have had an impact on hospital closures until after 1984, the PPS binary variable (0=pre-PPS, 1=post-PPS) was recoded to start in 1984, 1985, or 1986. The key to detecting a PPS effect on closures is whether the regression coefficient, c, on either PPS or TIME*PPS is statistically significant. In only one specification was c positive and statistically significant. It indicated that the PPS effect started in 1986 and was associated with an additional 24 closures per year. The reason a PPS effect was so difficult to detect is due to the large decline in closures in 1989. As can be seen Figure 3-1, the decline in 1989 results in an inverted U shaped time trend. The inverted U shape causes problems when estimating linear regressions. However, even though it is difficult to estimate the PPS effect with precision, it is quite apparent that annual closures are higher after PPS was implemented than before implementation.

It should also be noted that the 61 closures in 1989 is substantially higher than the annual number of closures prior to the implementation of PPS. The AHA reports (Burda, 1991) that the number of hospital closures in 1990 is down to 50. Again, even though the

FIGURE 3-1

Hospital Closures, 1980-89



number of closures declined in 1990, it is still above the pre-PPS annual average. The declining number of closures for 1989 and 1990 do raise the question of whether the PPS impact on hospital closures is diminishing and whether future closures will revert to the pre-PPS trend. Two reasons are presented that support a return to pre-PPS trends and one reason why closures could increase in the near future.

First, the number of closures cannot continue to be indefinitely greater than zero because the demand for hospital services will not, in the foreseeable future, fall to zero. Second, the population is both growing and aging which should counteract the PPS induced lowered demand for hospital services. Countering the return to lower annual levels of closures is the possibility that the inclusion of capital costs under PPS will stimulate a new round of increased hospital closures.

4.0 DESCRIPTIVE ANALYSIS OF FACTORS UNDERLYING HOSPITAL CLOSURES

In this chapter characteristics of closed hospitals relative to those that remained open during the 1980-89 period are examined. Differences in characteristics between counties with open and closed hospitals are analyzed next. Finally the utilization characteristics of open and closed hospitals are examined in the years prior to closure.

4.1 Characteristics of Open and Closed Hospitals, 1980-89

In Table 4-1 number of hospital closures is shown by various hospital characteristics and by year.* For comparison, column one provides the number of all short-term, acute care hospitals open throughout the 1980-89 period by their 1984 characteristics (except where the data are not available for that year). Hospitals with a change of service or that merged are not included in the number of open hospitals. Hence, 5,066 short-term acute care hospitals remained open for the entire 1980-89 period with no major change of service or consolidation with another hospital (see column 1 in Table 4-1). In comparison, 464 hospitals closed during this time (see the last column of Table 4-1). As noted in Chapter 3, closures increased in the post-PPS years (1984-89) with 355 (or 77%) of them occurring during this period.

Of the 5,066 open hospitals, slightly more than half (2,690) were in urban areas compared to 2,376 in rural areas. However, of the 464 hospitals that closed over the 1980-89 period, half were in urban areas (232) and half were in rural areas. However, for any one year, this may not hold true. In particular, during both the pre-PPS and PPS transition periods, urban closures exceeded rural closures while in the post-PPS period, rural closures (151) exceeded urban closures (125).

Both in urban areas and in rural areas, small hospitals were more likely to close than large ones, although in the post-PPS period, a few larger hospitals began to fail. For example, between 1980 and 1983, only one urban hospital with bedsize 300 or more closed, while three

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*Instead of being shown individually, the years are grouped to facilitate the presentation of the data. The years are grouped as follows: pre-PPS (1980-3), PPS transition (1984-5; see Chapter 3.5), and post-PPS (1986-9).

TABLE 4-1

DISTRIBUTION OF CHARACTERISTICS OF NON-FEDERAL, SHORT-TERM ACUTE-CARE HOSPITALS WHICH REMAINED OPEN THE ENTIRE PERIOD AND THOSE THAT CLOSED, 1980-89

	Hospitals That Remained Open 1980-89[a]	YEAR OF CLOSURE 1980-3	1984-5	1986-9	Total Closed
ALL	**5,066**	**109**	**79**	**276**	**464**
Urban	2,690	63	44	125	232
< 100 Beds	555	45	34	88	167
100-199	669	13	7	26	46
200-299	536	4	2	9	15
300-404	390	0	1	2	3
405-504	240	0	0	0	0
> 504	300	1	0	0	1
Rural	2,376	46	35	151	232
< 50 Beds	981	36	33	118	187
50- 99	774	9	1	28	38
100-169	401	0	1	5	6
> 169	220	1	0	0	1
Sole Community Hospital[b]	283	--	2	7	9
Rural Referral Center[b]	145	--	0	0	0
Other Rural	1,948	--	17	144	161
Ownership[c]					
Voluntary	2,909	44	32	122	198
Proprietary	644	48	33	95	176
Public	1,513	17	14	59	90
Teaching Status[d]					
Non-teaching	4,164	--	72	257	329
Other teaching	736	--	7	18	25
Major teaching	166	--	0	1	1
Disproportionate Share Status[e]					
Not qualified	4,070	--	--	169	169
Urban, Beds ≥ 100	771	--	--	18	18
Urban, Beds < 100	45	--	--	9	9
Rural	180	--	--	22	22
Medicare Inpatient Admissions as a Percentage of Total Inpatient Admissions the Year Prior to Closure[f]					
More than 42.25%	1,267	12	17	80	109
31.25% - 42.25%	2,417	37	43	135	215
Less than 31.25%	1,196	21	14	52	87

TABLE 4-1 (continued)

DISTRIBUTION OF CHARACTERISTICS OF NON-FEDERAL, SHORT-TERM ACUTE-CARE HOSPITALS WHICH REMAINED OPEN THE ENTIRE PERIOD AND THOSE THAT CLOSED, 1980-89

	Hospitals That Remained Open 1980-89[a]	YEAR OF CLOSURE 1980-3	1984-5	1986-9	Total Closed
Medicaid Inpatient Admissions as a Percentage of Total Inpatient Admissions the Year Prior to Closure[f]					
More than 11.18%	1,204	30	20	106	156
4.8% - 11.18%	2,403	31	39	114	184
Less than 4.8%	1,234	9	15	47	71
Region					
New England	222	6	1	7	14
Middle Atlantic	526	22	6	22	50
South Atlantic	763	11	11	21	43
East North Central	771	8	12	39	59
East South Central	450	11	6	21	38
West North Central	715	6	7	32	45
West South Central	710	18	19	85	122
Mountain	333	5	5	19	29
Pacific	576	22	12	30	64
PPS Waiver Status[g]					
Non-waivered	4,611	90	73	255	418
Waivered	455	19	6	21	46

Notes: [a] Year of data: 1984.

[b] The sole community hospital and rural referral center designations were part of the implementation of PPS. Statistics prior to 1985 are not meaningful. Values for the column for hospitals that remained open are based on their 1985 values.

[c] Based on AHA ownership codes.

[d] Based on HCFA's definition of teaching status. Data was not available for hospitals that closed prior to 1984.

[e] The disproportionate share status, as a new and separate designation, was implemented in May 1986. Statistics prior to 1987, therefore, are not meaningful. Values for the column for hospitals that remained open are based on their 1988 values.

[f] AHA data was used in order to obtain data prior to 1983.

[g] The PPS waivered states were Maryland, Massachusetts, New Jersey, and New York.

Source: CHER's Universe File.

such hospitals closed between 1984 and 1989. When looking at all urban hospitals with 200 or more beds, the trend is the same as for all hospital closures, with 26% occurring pre-1984 and 74% occurring post-1984. The trend is similar for rural hospitals, with 10 of the 45 larger hospital closures (50 beds or more) occurring pre-1984.

For 1985-89, data on the breakdown of rural hospitals by their community status are available. While 283 rural hospitals were sole community hospitals and 145 were rural referral centers in 1985, only nine of the former and none of the latter closed between 1985 and 1989.*

A disproportionate share of hospitals that closed during the 1980s were proprietary. Teaching and disproportionate share status are known only for the later years, but it is clear that nonteaching hospitals and hospitals with a larger share of Medicare and Medicaid patients are more likely to close. This suggests that the special status given to teaching hospitals does help prevent closure. However the special status given for serving a larger proportion of government insured patients does not decrease the likelihood of closure, although the program may not have been in effect long enough to make a difference. The one exception is for large urban hospitals with disproportionate share, which are actually are less likely to close than other hospitals. This result is not surprising since the definition of disproportionate share for these hospitals is much less stringent than for small urban and rural hospitals, so that hospitals with much lower percentages of Medicaid and Medicare admissions are included in this group.

Another way of analyzing the impact of federally insured patients on hospital closure is by comparing hospitals with different proportions of Medicare and Medicaid discharges. Hospitals with more than 42.24 percent Medicare discharges comprise the top quartile, while those with less than 31.25 percent Medicare admissions make up the bottom quartile.

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*Table 4-1 groups statistics on hospital closures for 1984 and 1985 into one column and closure statistics for 1986 through 1989 into another column. Because statistics on sole community hospital (SCH) and rural referral center (RRC) status are not meaningful prior to 1985 (see note b in Table 4-1), hospital closures by SCH, RRC, and "other rural" do not sum to 35 because the 35 hospital closures occurred over two years instead of one. Similarly, hospital closures by disproportionate share status do not sum to 276 for the years 1986-9 (see note e in Table 4-1). This aspect of Table 4-1 is also present in Tables 4-2 through 4-4.

Approximately equal numbers of open and closed hospitals in 1984 fall into these upper and lower quartiles suggesting that the proportion of Medicare patients is not a key factor underlying hospital viability. However, nearly twice as many hospitals can be found in the top quartile for Medicaid admissions as in the bottom quartile (156 compared to 71) suggesting that a disproportionately high share of Medicaid patients does increase the chance of closure.

Examining trends in closures by regions shows that for states in the central portion of the country, closures increased approximately four-fold in the post-PPS years. For example in both North Central regions and in the West South Central region, only about 14% of closures occurred between 1980-83 compared to 57% in the 1986-89 period. On the other hand, there is little difference in the number of closures in the two periods (1980-3 and 1986-9) for hospitals in the Middle Atlantic and in New England. This may be because of the PPS-waiver states are in these two regions. Indeed, the explicit comparison between waivered and nonwaivered states shows little difference in the per annum number of hospital closures in waivered states over the entire period, while closures in nonwaivered states increased markedly after 1983. While one might not expect waivered states to show an increase in closures until they were all on PPS in 1986, there is no dramatic increase in closures during the last two years either. Most likely state-specific regulation of hospital costs was as effective as PPS in weeding out failing hospitals and this trend began much earlier in the waivered areas than in the other states.

Table 4-2 explicitly shows the proportion of hospitals by different characteristics, enhancing the comparability among different types of hospitals with respect to closure. For example, while urban hospitals comprise 53.1 percent of all open hospitals, only 50 percent of hospitals that closed between 1980 and 1989 were in urban areas, suggesting that rural hospitals are slightly more likely to close than urban ones.

Much more striking than the urban/rural effect on closure is that of bedsize. Smaller hospitals are much more likely to close than larger hospitals, whether they are in an urban or rural area. While only 20.6 percent of open urban hospitals in 1984 had fewer than 100 beds, 72 percent of urban hospitals that closed in the 1980-89 period had fewer than 100 beds. Similarly, 41 percent of open rural hospitals have fewer than 50 beds, yet 80.6 percent of closed

TABLE 4-2

PERCENTAGE DISTRIBUTION OF CHARACTERISTICS OF NON-FEDERAL, SHORT-TERM ACUTE-CARE HOSPITALS WHICH REMAINED OPEN THE ENTIRE PERIOD AND THOSE THAT CLOSED, 1980-89[a]

	Hospitals That Remained Open 1980-89[b]	YEAR OF CLOSURE			Total Closed
		1980-3	1984-5	1986-9	
ALL (Count)	**5,066**	**109**	**79**	**276**	**464**
Urban[c]	53.1%	57.8%	55.7%	45.3%	50.0%
< 100 Beds	20.6	71.4	77.3	70.4	72.0
100-199	24.9	20.6	15.9	20.8	19.8
200-299	19.9	6.3	4.5	7.2	6.5
300-404	14.5	0.0	2.3	1.6	1.3
405-504	8.9	0.0	0.0	0.0	0.0
> 504	11.2	1.6	0.0	0.0	0.4
Rural[d]	46.9	42.2	44.3	54.7	50.0
< 50 Beds	41.3	78.3	94.3	78.1	80.6
50- 99	32.6	19.6	2.9	18.5	16.4
100-169	16.9	0.0	2.9	3.3	2.6
> 169	9.3	2.2	0.0	0.0	0.4
Sole Community Hospital[e]	11.9	--	10.5	5.3	5.3
Rural Referral Center[e]	6.1	--	0.0	0.0	0.0
Other Rural	82.0	--	89.5	95.4	94.7
Ownership[f]					
Voluntary	57.4	40.4	40.5	44.2	42.7
Proprietary	12.7	44.0	41.8	34.4	37.9
Public	29.9	15.6	17.7	21.4	19.4
Teaching Status[g]					
Non-teaching	82.2	--	91.1	93.1	92.7
Other teaching	14.5	--	8.9	6.5	7.0
Major teaching	3.3	--	0.0	0.4	0.3
Disproportionate Share Status[h]					
Not qualified	80.3	--	--	77.5	77.5
Urban, Beds ≥ 100	15.2	--	--	8.3	8.3
Urban, Beds < 100	0.9	--	--	4.1	4.1
Rural	3.6	--	--	10.1	10.1
Medicare Inpatient Admissions as a Percentage of Total Inpatient Admissions the Year Prior to Closure[i]					
More than 42.25%	26.0	17.1	23.0	30.0	26.5
31.25% - 42.25%	49.5	52.9	58.1	50.6	52.3
Less than 31.25%	24.5	30.0	18.9	19.5	21.2

TABLE 4-2 (continued)

PERCENTAGE DISTRIBUTION OF CHARACTERISTICS OF NON-FEDERAL, SHORT-TERM ACUTE-CARE HOSPITALS WHICH REMAINED OPEN THE ENTIRE PERIOD AND THOSE THAT CLOSED, 1980-89[a]

	Hospitals That Remained Open 1980-89[b]	YEAR OF CLOSURE 1980-3	1984-5	1986-9	Total Closed
Medicaid Inpatient Admissions as a Percentage of Total Inpatient Admissions the Year Prior to Closure[i]					
More than 11.18%	24.9	42.9	27.0	39.7	38.0
4.8% - 11.18%	49.6	44.3	52.7	42.7	44.8
Less than 4.8%	25.5	12.9	20.3	17.6	17.3
Region					
New England	4.4	5.5	1.3	2.5	3.0
Middle Atlantic	10.4	20.2	7.6	8.0	10.8
South Atlantic	15.1	10.1	13.9	7.6	9.3
East North Central	15.2	7.3	15.2	14.1	12.7
East South Central	8.9	10.1	7.6	7.6	8.2
West North Central	14.1	5.5	8.9	11.6	9.7
West South Central	14.0	16.5	24.1	30.8	26.3
Mountain	6.6	4.6	6.3	6.9	6.3
Pacific	11.4	20.2	15.2	10.9	13.8
PPS Waiver Status[j]					
Non-waivered	91.0	82.6	92.4	92.4	90.1
Waivered	9.0	17.4	7.6	7.6	9.9

Notes:
[a] Except for rounding error and as otherwise noted, column percentages for a classification add up to 100 percent.
[b] Year of data: 1984.
[c] The column percentages for the urban bed size categories add up to 100 percent instead of the percentage value on the Urban row.
[d] The column percentages for the rural bed size categories add up to 100 percent instead of the percentage value on the Rural row. Likewise, the column percentages for the special rural designations also add up to 100 percent instead of the percentage value on the Rural row.
[e] The sole community hospital and rural referral center designations were part of the implementation of PPS. Statistics prior to 1985 are not meaningful. Values for the column for hospitals that remained open are based on their 1988 values.
[f] Based on AHA ownership codes.
[g] Based on HCFA's definition of teaching status. Data was not available for hospitals that closed prior to 1984.
[h] The disproportionate share status, as a new and separate designation, was implemented in May 1986. Statistics prior to 1987, therefore, are not meaningful. Values for the column for hospitals that remained open are based on their 1988 values.
[i] AHA data was used in order to obtain data prior to 1983.
[j] The PPS waivered states were Maryland, Massachusetts, New Jersey, and New York.

Source: CHER's Universe File.

rural hospitals had fewer than 50 beds. Bedsize may even underlie the results for community status. For example, rural referral centers are likely to be among the larger rural hospitals, possibly explaining the lack of closures in this group. Sole community hospitals are also under-represented among closed hospitals.

Also striking are the differences in ownership with respect to open and closed hospitals. Proprietary hospitals accounted for only 12.7 percent of open short-term, acute-care hospitals in 1984, but account for 37.9 percent of hospitals closing during the study period. On the other hand, public hospitals accounted for about 30 percent of open hospitals, but only 19 percent of those closing between 1980 and 1989.

As discussed above, nonteaching hospitals appear most likely to close, while only one major teaching hospital closed during the study years. Hospitals not qualifying for disproportionate share status (based on the number Medicare and Medicaid patients) are somewhat less likely to close (80.3% of open hospitals did not qualify compared to 77.5% of closed). This was true to a larger extent for large urban hospitals that do qualify as having a disproportionate share of Medicare and Medicaid patients. These urban qualifying hospitals comprised 15 percent of open hospitals and only 8 percent of closed. This result is in sharp contrast to small urban hospitals and rural hospitals with a large share of federally insured patients, which show up as a substantially larger proportion of closed hospitals than open. (Again, more stringent rules for qualification may explain the differences between small and large urban hospitals qualifying for disproportionate share.)

Not only did hospital closures in the West South Central region increase in the later years, closures occurred disproportionately more in this region than in others during the study period. Only 14.0 percent of open hospitals were located in the West South Central region in 1984, but 26.3 percent of hospitals that closed during 1980-89 were in this region. By contrast, closures in the 3 other central regions during this period were under-represented relative to open hospitals in these areas. In addition to the West South Central region, hospitals were more likely to close in Pacific region, and slightly less likely to close in New England than in other regions. However, there was little apparent difference in 1980-89 closures between waivered and nonwaivered states.

4.2 Hospital Characteristics by Bedsize, 1980-89

Because small hospitals were more likely to close in the 1980s than large ones, counts of individual hospitals are likely to overstate the effect of closures on total industry capacity. For this reason, hospital closures are presented in terms of beds lost in Table 4-3, giving a clearer picture of the effects of closure on industry capacity. Hence the 5,066 hospitals open during the entire 1980-89 study period represented 904,340 beds (see column 1 of Table 4-3). While closed hospitals are 9.2% of these open hospitals, only 27,155 (or 3% of the open beds) were lost as a result of closures.

The 8,469 beds lost in rural hospitals represent 30 percent of all lost beds while rural hospital closures account for half of all closures. This reflects the smaller size of rural hospitals. Similarly, while closed sole community hospitals comprised 3.2% of open hospitals and other rural hospitals comprised 8.3% of open hospitals, these numbers fall to 1.5% and 4.4% respectively when accounting for bedsize.

For disproportionate share status, accounting for hospital size actually increases the relative differences between the groups. For hospitals that don't qualify, and for large urban hospitals that do qualify, the percentage of closed beds is very small (less than one percent) while the proportions of qualifying small urban and rural hospitals are still sizable, 16.4 and 7.8 percent, respectively.

In terms of closure trends, bed counts confirm what was already shown in Table 4-1. Hospital closures accelerated in the 1986-89 period, to about twice that of the 1980-83 period for both urban and rural, small and large hospitals. The loss of bed capacity in the North Central regions was even more pronounced in the 1986-89 period than the loss of hospitals, with approximately 29 percent of bed loss occurring in the earlier period and 53 percent in the later period, suggesting that larger hospitals closed in these regions after 1985.

The one exception to trends shown in Table 4-1 is the trend for public hospital beds. Although both the numbers of hospital closures and beds lost among public hospitals are greater during the 1986-89 period than in the 1980-83 period, the decrease is much less pronounced in terms of bedsize. This suggests that while more public hospitals closed in the mid- and late 1980s, they tended to be smaller on average than the ones that closed in the early 1980s.

TABLE 4-3

DISTRIBUTION OF CHARACTERISTICS OF NON-FEDERAL, SHORT-TERM ACUTE-CARE HOSPITAL BEDS IN HOSPITALS WHICH REMAINED OPEN THE ENTIRE PERIOD AND THOSE WHICH CLOSED, 1980-89

	Beds in Hospitals That Remained Open 1980-89[a]	YEAR OF CLOSURE			Total Closed
		1980-3	1984-5	1986-9	
ALL	**904,340**	**7,037**	**4,371**	**15,747**	**27,155**
Urban	712,839	5,401	3,302	9,983	18,686
< 100 Beds	35,031	2,190	1,495	4,026	7,711
100-199	97,537	1,769	991	3,323	6,083
200-299	131,674	934	439	1,984	3,357
300-404	134,278	0	377	650	1,027
405-504	107,393	0	0	0	0
> 504	206,926	508	0	0	508
Rural	191,501	1,636	1,069	5,764	8,469
< 50 Beds	32,719	863	842	3,256	4,691
50- 99	53,910	601	76	1,910	2,587
100-169	50,845	0	151	598	749
> 169	54,027	172	0	0	172
Sole Community Hospital[b]	16,190	--	65	176	241
Rural Referral Center[b]	34,849	--	0	0	0
Other Rural	140,462	--	554	5,588	6,142
Ownership[c]					
Voluntary	636,783	3,059	1,899	8,487	13,445
Proprietary	89,224	2,672	1,731	5,015	9,418
Public	178,333	1,306	741	2,245	4,292
Teaching Status[d]					
Non-teaching	544,885	--	3,492	13,196	16,688
Other teaching	272,821	--	879	2,408	3,287
Major teaching	86,634	--	0	143	143
Disproportionate Share Status[e]					
Not qualified	637,886	--	--	8,824	8,824
Urban, Beds ≥ 100	252,417	--	--	2,751	2,751
Urban, Beds < 100	2,859	--	--	468	468
Rural	11,178	--	--	875	875
Medicare Inpatient Admissions as a Percentage of Total Inpatient Admissions the Year Prior to Closure[f]					
More than 42.25%	128,750	644	535	3,180	4,359
31.25% - 42.25%	416,971	1,370	2,564	8,358	12,292
Less than 31.25%	339,082	1,974	1,030	3,714	6,718

TABLE 4-3 (continued)

DISTRIBUTION OF CHARACTERISTICS OF NON-FEDERAL, SHORT-TERM ACUTE-CARE HOSPITAL BEDS IN HOSPITALS WHICH REMAINED OPEN THE ENTIRE PERIOD AND THOSE WHICH CLOSED, 1980-89

	Beds in Hospitals That Remained Open 1980-89[a]	YEAR OF CLOSURE 1980-3	1984-5	1986-9	Total Closed
Medicaid Inpatient Admissions as a Percentage of Total Inpatient Admissions the Year Prior to Closure[f]					
More than 11.18%	250,427	1,906	1,544	5,897	9,347
4.8% - 11.18%	396,582	1,693	1,635	7,356	10,684
Less than 4.8%	232,406	389	950	1,999	3,338
Region					
New England	47,698	150	69	305	524
Middle Atlantic	152,618	2,938	839	2,054	5,831
South Atlantic	156,426	440	593	1,369	2,402
East North Central	167,106	403	760	3,280	4,443
East South Central	69,708	615	225	1,024	1,864
West North Central	77,372	289	530	1,848	2,667
West South Central	103,882	709	689	3,309	4,707
Mountain	38,082	134	107	770	1,011
Pacific	91,448	1,359	559	1,788	3,706
PPS Waiver Status[g]					
Non-waivered	764,612	4,790	3,498	13,909	22,197
Waivered	139,728	2,247	873	1,838	4,958

Notes:
[a] Year of data: 1984.
[b] The sole community hospital and rural referral center designations were part of the implementation of PPS. Statistics prior to 1985 are not meaningful. Values for the column for hospitals that remained open are based on their 1985 values.
[c] Based on AHA ownership codes.
[d] Based on HCFA's definition of teaching status. Data was not available for hospitals that closed prior to 1984.
[e] The disproportionate share status, as a new and separate designation, was implemented in May 1986. Statistics prior to 1987, therefore, are not meaningful. Values for the column for hospitals that remained open are based on their 1988 values.
[f] AHA data was used in order to obtain data prior to 1983.
[g] The PPS waivered states were Maryland, Massachusetts, New Jersey, and New York.

Source: CHER's Universe File.

Table 4-4 shows the distribution of hospital beds by hospital characteristics for open and closed hospitals. Because urban hospitals are larger on average than rural hospitals and because small hospitals are more likely to close, there is a larger disparity between the beds lost in urban areas versus those in rural areas than was found for hospital closures. While only 21.2 percent of open beds in 1984 could be found in rural areas, nearly 31.2 percent of beds lost between 1980 and 1989 were in rural areas.

In general however, the relative differences between open and closed hospitals is the same whether looking at total hospital counts or at bedsize. Industry capacity loss due to closures has been disproportionately greater among smaller hospitals, whether in urban or rural areas. It has also been greater in proprietary hospitals, nonteaching hospitals and in small urban and rural hospitals with a disproportionate share of federally insured patients, and in hospitals with the highest proportion of Medicaid admissions.

Table 4-4 also shows that the Pacific, West South Central and Middle Atlantic regions were more highly represented among closed beds than open ones. Of course, hospitals in these areas were also more likely to close. However, this effect was stronger in the Pacific and Middle Atlantic when hospital size was taken into account, suggesting that larger hospitals are closing in these areas. In contrast, the effect in the West South Central region was reduced when accounting for bedsize, suggesting that while many hospitals closed, they were fairly small on average. Surprisingly, while the West North Central region comprised a smaller proportion of closed than open hospitals (9.7% vs. 14.1%), it comprised a larger proportion of closed beds than open beds (9.8% vs. 8.6%). Clearly this region has smaller hospitals on average than other regions.

Beds in waivered states were slightly more represented among closed hospitals (comprising 18.3% of all closed beds during 1980-89) than among open beds (15.5%). Also, a larger proportion of open and closed beds were in waiver states than open and closed hospitals, reflecting the larger average hospital size in these areas.

TABLE 4-4

PERCENTAGE DISTRIBUTION OF CHARACTERISTICS OF NON-FEDERAL, SHORT-TERM ACUTE-CARE HOSPITAL BEDS IN HOSPITALS WHICH REMAINED OPEN THE ENTIRE PERIOD AND THOSE WHICH CLOSED, 1980-89[a]

	Beds in Hospitals That Remained Open 1980-89[b]	YEAR OF CLOSURE 1980-3	1984-5	1986-9	Total Closed
ALL (Count)	**904,340**	**7,037**	**4,371**	**15,747**	**27,155**
Urban[c]	78.8	76.8	75.5	63.4	68.8
< 100 Beds	4.9	40.5	45.3	40.3	41.3
100-199	13.7	32.8	30.0	33.3	32.6
200-299	18.5	17.3	13.3	19.9	18.0
300-404	18.8	0.0	11.4	6.5	5.5
405-504	15.1	0.0	0.0	0.0	0.0
> 504	29.0	9.4	0.0	0.0	2.7
Rural[d]	21.2	23.2	24.5	36.6	31.2
< 50 Beds	17.1	52.8	78.8	56.5	58.6
50- 99	28.2	36.7	7.1	33.1	30.5
100-169	26.6	0.0	14.1	10.4	8.8
> 169	28.2	10.5	0.0	0.0	2.0
Sole Community Hospital[e]	8.5	--	10.5	3.8	3.8
Rural Referral Center[e]	18.2	--	0.0	0.0	0.0
Other Rural	73.3	--	89.5	96.9	96.2
Ownership[f]					
Voluntary	70.4	43.5	43.4	53.9	49.5
Proprietary	9.9	38.0	39.6	31.8	34.7
Public	19.7	18.6	17.0	14.3	15.8
Teaching Status[g]					
Non-teaching	60.3	--	79.9	83.8	83.0
Other teaching	30.2	--	20.1	15.3	16.3
Major teaching	9.6	--	0.0	0.9	0.7
Disproportionate Share Status[h]					
Not qualified	70.5	--	--	68.3	68.3
Urban, Beds ≥ 100	27.9	--	--	21.3	21.3
Urban, Beds < 100	0.3	--	--	3.6	3.6
Rural	1.2	--	--	6.8	6.8
Medicare Inpatient Admissions as a Percentage of Total Inpatient Admissions the Year Prior to Closure[i]					
More than 42.25%	14.6	16.1	13.0	20.8	18.7
31.25% - 42.25%	47.1	34.4	62.1	54.8	52.6
Less than 31.25%	38.3	49.5	24.9	24.4	28.7

TABLE 4-4 (continued)

PERCENTAGE DISTRIBUTION OF CHARACTERISTICS OF NON-FEDERAL, SHORT-TERM ACUTE-CARE HOSPITAL BEDS IN HOSPITALS WHICH REMAINED OPEN THE ENTIRE PERIOD AND THOSE WHICH CLOSED, 1980-89[a]

	Beds in Hospitals That Remained Open 1980-89[b]	YEAR OF CLOSURE			Total Closed
		1980-3	1984-5	1986-9	
Medicaid Inpatient Admissions as a Percentage of Total Inpatient Admissions the Year Prior to Closure[i]					
More than 11.18%	28.5	47.8	37.4	38.7	40.0
4.8% - 11.18%	45.1	42.5	39.6	48.2	45.7
Less than 4.8%	26.4	9.8	23.0	13.1	14.3
Region					
New England	5.3	2.1	1.6	1.9	1.9
Middle Atlantic	16.9	41.8	19.2	13.0	21.5
South Atlantic	17.3	6.3	13.6	8.7	8.8
East North Central	18.5	5.7	17.4	20.8	16.4
East South Central	7.7	8.7	5.1	6.5	6.9
West North Central	8.6	4.1	12.1	11.7	9.8
West South Central	11.5	10.1	15.8	21.0	17.3
Mountain	4.2	1.9	2.4	4.9	3.7
Pacific	10.1	19.3	12.8	11.4	13.6
PPS Waiver Status[j]					
Non-waivered	84.5	68.1	80.0	88.3	81.7
Waivered	15.5	31.9	20.0	11.7	18.3

Notes:
[a] Except for rounding error and as otherwise noted, column percentages for a classification add up to 100 percent.
[b] Year of data: 1984.
[c] The column percentages for the urban bed size categories add up to 100 percent instead of the percentage value on the Urban row.
[d] The column percentages for the rural bed size categories add up to 100 percent instead of the percentage value on the Rural row. Likewise, the column percentages for the special rural designations also add up to 100 percent instead of the percentage value on the Rural row.
[e] The sole community hospital and rural referral center designations were part of the implementation of PPS. Statistics prior to 1985 are not meaningful. Values for the column for hospitals that remained open are based on their 1988 values.
[f] Based on AHA ownership codes.
[g] Based on HCFA's definition of teaching status. Data was not available for hospitals that closed prior to 1984.
[h] The disproportionate share status, as a new and separate designation, was implemented in May 1986. Statistics prior to 1987, therefore, are not meaningful. Values for the column for hospitals that remained open are based on their 1988 values.
[i] AHA data was used in order to obtain data prior to 1983.
[j] The PPS waivered states were Maryland, Massachusetts, New Jersey, and New York.

Source: CHER's Universe File.

4.3 Area Characteristics Underlying Hospital Viability

Table 4-5 shows area characteristics of urban and rural hospitals, allowing examination of possible market effects underlying closure. For example, hospitals with low and/or decreasing population in their market area, may have insufficient demand to stay open. By definition, urban counties are more populous than rural. Similarly, rural counties with only one hospital (i.e. monopoly counties) should be less populous than other rural counties. Table 4-5 confirms that urban counties with hospital closures between 1980 and 1989 are larger than rural counties with closures (249,000 people on average compared to only 25,800 in rural closure counties in 1982), and that monopoly counties with closures had the fewest (only 11,800 on average in 1982). Rural counties without any hospital closures were actually slightly smaller than those with closures, only 25,200 on average, suggesting that population size alone does not affect hospital viability (see column 5 in Table 4-5).

By 1988 average population size increased in all county groups but monopoly counties (see row 2 of Table 4-5). However, decreases were larger than increases on an individual county level for rural counties with closures, so that averaging these changes shows declining population for rural counties with more than one hospital prior to closure (see row 3, column 4). By contrast, urban counties with closures had an average 8% increase in population between 1982 and 1988, while rural counties without closures showed a small .5% increase. Clearly, while decreasing population may contribute to rural hospital closures, it does not seem to be a factor in urban closures. Nor does a lower population density or a larger over 65 population seem to contribute to closure since these statistics differ little between rural closure counties and rural counties with no closures. Differences in these variables between urban and rural counties simply reflect demographic differences.

Population alone is a very crude estimate of demand effects on hospitals because it does not account for the number of hospitals in a county. Individual hospitals in two counties with the same population presumably face different demand constraints if one hospital is in a monopoly county and the other is one of three hospitals in a county with 3 times as many beds. To account for the presence of other hospitals and varying industry capacity among

TABLE 4-5

CHARACTERISTICS OF URBAN AND RURAL COUNTIES WITH AND WITHOUT SHORT-TERM ACUTE-CARE HOSPITAL CLOSURES, 1980-88

Characteristic	All Urban Counties With Hospital Closures	RURAL COUNTIES			
		All Counties with Closures	Closures in Counties Which Had One Hospital	Closures in Counties With More Than One Hospital	Counties With No Hospital Closures
Population, 1982 (1,000s)	250.6	31.5	13.0	38.1	25.1
Population, 1988 (1,000s)	268.2	31.7	12.6	38.6	25.7
Percentage change in population (1982-88)	7.82%	-0.50%	-1.76%	-0.04%	0.49%
Population per square mile (1988)	767	42	23	49	41
Percentage of population aged 65 and older (1984)	11.2%	14.9%	15.0%	14.8%	14.6%
Herfindahl index (1984)	0.249	.672	1.000	0.566	0.876
Non-federal physicians per 1,000 population (1985)	1.48	0.77	0.48	0.88	0.75
Per capita income, 1982	$10,359	$8,662	$8,014	$8,896	$8,838
Per capita income, 1988	$15,523	$12,245	$11,855	$12,385	$12,492
Percentage change in per capita income (1982-88)	50.2%	43.4%	49.9%	41.1%	43.3%
Percentage of population receiving Aid to Families with Dependent Children, (1980)	3.5%	4.0%	4.3%	3.9%	3.3%
Percentage of population below poverty level (1979)	11.3%	17.9%	21.1%	16.7%	16.7%

Note: All values are unweighted means.

Source: Area Resource File except for the Herfindahl index. The Herfindahl index was calculated using data from CHER's Universe file.

market areas, the mean number of physicians per 1,000 people and the mean Herfindahl Index value for the different county groups are shown. The closer the Herfindahl index value to 0, the more competitive the market area. Areas with only one hospital are considered monopolies and have a Herfindahl index value of one, hence, the mean for rural monopoly closure counties is 1. Not surprisingly, urban closure counties are the most competitive showing an index value of .222, compared to .857 for rural closure counties and .881 for other rural counties. The difference between rural counties with and without closures suggests that rural hospitals in more competitive areas are more likely to close. The mean number of physicians is also larger in urban than in rural counties, but unlike the Herfindahl Index, shows little difference between rural counties with closures and those without.

Not accounted for in any of the above measures is the lack of demand a hospital may face due to an inability for people to pay for the services. To measure this potential factor on hospital closures, differences in mean per capita income and changes in income among the different county groups are also shown. Unfortunately, only data on nominal income are available, and the differences in the cost of living among these areas and over time is well known. As a result, our numbers reflect these differences rather than real income differences among the groups and over time. Comparing rural counties with closures and those without closures does hold geographical cost-of-living differences constant to some extent, and per capita income is somewhat lower in rural counties with closures (about $20 less in both 1982 and 1988). However, averaging the individual changes in nominal per capita income for these two groups shows little difference (both show increases of about 43%).

Per capita income also fails to measure distributional differences, so that incomes may appear higher in areas where a few high income people live, but where the majority of residents cannot afford health care. For this reason other measures of poverty, such as the proportion of people below the poverty line and the proportion receiving governmental income assistance (AFDC), are shown. Although these statistics are dated (existing only for 1980 and 1979, respectively) rural counties with hospital closures show a slightly higher percentage of poor people and a slightly higher percentage of people receiving AFDC than do rural counties without closures. This result suggests that hospital closures may be further curbing access to health care for the poor. Even the percentage of people on AFDC in urban

closure areas is slightly larger than those in rural counties in spite of the fact that eligibility criteria rarely take geographical cost-of-living differences into account. (Poverty levels also fail to account for such differences). Given the large number of problems with these statistics, it is likely that the effect of poverty on demand factors has been underestimated, particularly in urban counties.

There were 60 counties, with only one open hospital in 1980, that had a hospital closure between 1980 and 1989 (Table 4-6). Of these 60 counties, 57 were rural counties and three were urban counties. Another 104 counties, with two open hospitals in 1980, had at least one hospital closure between 1980 and 1989. Of these 104 counties, 85 were rural counties and 19 were urban counties. As might be expected, rural counties which had hospital closures did not have very many hospitals at the beginning of the 1980s. There were only two rural counties which experienced a closure between 1980 and 1989 that had more than five open hospitals in 1980 (Table 4-6). Urban counties which had at least one hospital closure between 1980 and 1989, in contrast, often had more than five open hospitals in 1980. However, there were also a fair number of instances in which the urban counties had five or fewer hospitals open in 1980. Because many urban areas have more than one constituent county, the number of urban areas (MSAs) that had at least one hospital closure is less than the 119 counties indicated in Table 4-6.

4.4 Utilization Data

The basic data on hospitals that closed and those that remained open comes from CHER's Universe file. The primary information on each hospital in the Universe file, including a hospital identification code, was obtained from annual surveys of hospitals conducted by the American Hospital Association (AHA) -- see Chapter 2 for details. Because the AHA does not release revenue data obtained in the surveys, other sources of data are necessary. In this chapter, utilization data were obtained from Medicare Cost Reports for the years 1983-88.

The Medicare Cost Report (MCR) data was linked to the basic AHA records for each hospital. It was not possible, however, to find a MCR record for each AHA record,

TABLE 4-6

THE NUMBER OF COUNTIES IN WHICH A HOSPITAL CLOSED (1980-89) BY THE NUMBER OF HOSPITALS OPEN IN THE COUNTY, 1980

Number of Open Hospitals in 1980	NUMBER OF COUNTIES		
	Total	Rural	Urban
1	60	57	3
2	104	85	19
3	55	48	7
4	22	12	10
5	20	10	10
6-10	31	2	29
11-15	15	0	15
16-20	9	0	9
21 or more	17	0	17
TOTAL	**333**	**214**	**119**

particularly among closed hospitals. Of the 355 hospitals which closed between 1984 and 1989, it was not possible to find any MCR record (for any year) for 58 hospitals. The year for which had there were the worst problems in obtaining a match was 1984; 22 of the 58 hospitals without any MCR data were for this year. Of the 37 hospitals which closed in 1984, there was data for only 15 hospitals. The most likely reason that data was not available for the hospitals that closed in 1984 is that they did not file Medicare Cost Reports (many of which might have been for fiscal year 1983 rather than 1984). Not filing a Medicare Cost Report is also a possibility for the eight of the 42 hospitals which closed in 1985 for which a record could not be found. (It was noted in Chapter 2 that there is sometimes a discrepancy between the date which operations cease and the surrender of the operating license. State licensing boards often are not certain which date they are reporting in their own reports. And it is difficult to obtain accurate information on closures which happened earlier in the decade.)

Of the remaining 28 hospitals for which a record could not be found, there are two likely reasons. First, some of the hospitals which CHER defines as a short-term, acute-care general hospital are considered by HCFA as PPS exempt hospitals and thus such records were not available to CHER. No more than fifteen of the 28 hospitals might have been PPS exempt. Second, Abt Associates, was responsible for creating an analytic database based on Medicare Cost Reports. There were a number of instances in which there were either multiple AHA records for a single MCR provider ID or multiple MCR records for a given AHA hospital ID. Because of a severe time constraint on another HCFA funded project,* Abt Associates did not try to reconcile the above problem of multiple records.

In addition to missing records, there are problems with item nonresponse and inaccurate data. It was noted by Hadley (1989) that AHA cost data did not appear to be reliable for the year of closure. Because of the high likelihood of inaccurate data for the year of closure, only data for years prior to the date of closure were used (a large proportion of the MCR data comes from unaudited Medicare Cost Reports).

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*During the summer of 1990, CHER analyzed capital costs for HCFA. The analytic database for this analysis was put together by Abt Associates. Because of the tight time schedule for CHER's analysis, Abt Associates were obliged to construct the analytic database as quickly as possible.

For closed hospitals, the means (unweighted) reported in this chapter are often based very few observations. For instance, it was noted above that records could not be found for 22 of the 37 hospitals which closed in 1984. Because of the small number of observations, all available observations were used which passed data reliability checks. Thus, there is a maximum of 15 hospitals used in the calculations for hospitals which closed in 1984. For 1985 closures, 26-31 observations were used; for 1986 closures, 42-48 observations were used in calculating means for each year prior to closure; for 1987 closures, 46-52 observations were used in calculating means for each year prior to closure; for 1988 closures, 72-76 observations were used in calculating means for each year prior to closure; and, for 1989 closures, 42-51 observations were used in calculating means for each year prior to closure.*

Because of the low number of observations upon which the means for closed hospitals are based, the values reported in subsequent sections should be cautiously interpreted. For instance, it was found that average costs were increasing in closed hospitals at a greater rate than for open hospitals.** It is likely that this conclusion would not be changed by additional observations for each calculation. However, it is quite possible that the magnitude of the differential would be different if additional observations were available.

4.5 Utilization Factors Underlying Hospital Closure

To further examine factors contributing to hospital closure utilization data for open and closed hospitals are compared in Tables 4-7 through 4-14. Table 4-7 shows mean annual inpatient discharges for four different groups of open hospitals and for closed hospitals by year. As shown above, closed hospitals tend to be smaller and slightly more rural than the average hospital, making total open hospitals an inappropriate control group. For this

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*These numbers are for the year prior to closure. The number of observations available for earlier years are usually higher.

**See Chapter 5.

TABLE 4-7

MEAN ANNUAL INPATIENT DISCHARGES, CLOSED HOSPITALS (1984-1989) AND HOSPITALS WHICH REMAINED OPEN BETWEEN 1980 AND 1989

	HOSPITALS THAT REMAINED OPEN									
		Hospitals With Less Than 200 Beds			Year in Which Hospital Closed					
Year	All	All	Urban	Rural	1989	1988	1987	1986	1985	1984
1988	5,657	2,380	3,466	1,796	924					
1987	5,674	2,419	3,496	1,836	1,031	1,287				
1986	5,755	2,493	3,543	1,925	1,114	1,548	1,238			
1985	5,992	2,625	3,712	2,042	1,183	1,725	1,387	1,194		
1984	6,162	2,799	3,890	2,208	1,384	1,868	1,586	1,279	2,042	
1983	6,039	2,922	3,975	2,362	1,475	2,007	1,708	1,433	1,706	1,162

Source: Medicare Cost Reports.

reason mean annual discharges for all open hospitals with less than 200 beds, open urban hospitals with less than 200 beds, and open rural hospitals with less than 200 beds are also shown. In 1988, mean annual discharges for open hospitals were highest when including all hospitals (5,657) and lowest for small rural hospitals (1,796). By contrast, for hospitals that closed in 1989, the unweighted average inpatient discharge was 924.

To determine whether or not low utilization contributed to closure, the discharge pattern in the years prior to closure must be examined. For hospitals that closed in 1989, average annual discharges were lower than all control groups of open hospitals back to 1983.* In addition, they decreased steadily from 1,475 in 1983 to 924 in 1988, the year prior to closure, suggesting falling demand. Average annual discharges also decreased steadily in all small open hospitals, but not by as much as in closed hospitals. For example, mean discharges in small open rural hospitals only decreased from 2,362 in 1983 to 1,796 in 1988. The same trend of fewer discharges and larger decreases in discharges for closed hospitals than for open can be found for most closure years, with mean discharges varying from a low of 924 in the year prior to closure (for 1989 closures) to a high of 2,042 in the year prior to closure (for 1985 closures).

Looking at Medicare discharges separately in Table 4-8 shows the same trends. Mean discharges are lower for closed hospitals in every year than for open hospitals, even small rural open hospitals. Mean discharges in closed hospitals also decrease more in the years prior to closure than those in open hospitals.

Unlike mean discharges, mean days of care are not always lower for closed hospitals in the years prior to closure than they are for open hospitals. Table 4-9 shows that for hospitals closing in 1988, mean days of care were comparable to small open rural hospitals in 1983 and 1984, but started to decrease relative to open hospitals in 1986. Mean Medicare inpatient days (Table 4-10), however, were lower for hospitals that closed for any year than any of the control groups of hospitals that remained open for the entire decade.

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*Discharge data from Medicare Cost Reports were not available prior to 1983.

TABLE 4-8

MEAN ANNUAL MEDICARE INPATIENT DISCHARGES, CLOSED HOSPITALS (1984-1989) AND HOSPITALS WHICH REMAINED OPEN BETWEEN 1980 AND 1989

	HOSPITALS THAT REMAINED OPEN									
		Hospitals With Less Than 200 Beds			Year in Which Hospital Closed					
Year	All	All	Urban	Rural	1989	1988	1987	1986	1985	1984
1988	1,831	873	1,178	709	362					
1987	1,808	869	1,162	711	367	432				
1986	1,825	885	1,175	728	411	510	318			
1985	1,893	934	1,232	774	458	564	387	345		
1984	1,986	1,008	1,315	841	530	624	469	388	528	
1983	2,023	1,070	1,366	913	571	689	550	430	503	545

Source: Medicare Cost Reports.

TABLE 4-9

MEAN ANNUAL INPATIENT DAYS, CLOSED HOSPITALS (1984-1989) AND HOSPITALS WHICH REMAINED OPEN BETWEEN 1980 AND 1989

	HOSPITALS THAT REMAINED OPEN									
		Hospitals With Less Than 200 Beds			Year in Which Hospital Closed					
Year	All	All	Urban	Rural	1989	1988	1987	1986	1985	1984
1988	33,272	12,191	18,807	8,629	6,497					
1987	33,713	12,407	18,874	8,907	6,788	7,557				
1986	34,173	12,797	19,267	9,301	7,120	8,704	7,159			
1985	35,845	13,479	20,161	9,898	7,862	9,897	8,275	6,724		
1984	38,117	14,751	21,660	11,014	8,640	11,282	9,735	8,000	12,089	
1983	41,083	17,197	24,594	13,268	9,870	13,268	11,779	9,375	11,500	7,931

Source: Medicare Cost Reports.

TABLE 4-10

MEAN ANNUAL MEDICARE INPATIENT DAYS, CLOSED HOSPITALS (1984-1989) AND HOSPITALS WHICH REMAINED OPEN BETWEEN 1980 AND 1989

	HOSPITALS THAT REMAINED OPEN									
		Hospitals With Less Than 200 Beds			Year in Which Hospital Closed					
Year	All	All	Urban	Rural	1989	1988	1987	1986	1985	1984
1988	15,498	6,274	9,006	4,804	2,930					
1987	15,348	6,238	8,904	4,801	3,072	3,487				
1986	15,369	6,341	8,980	4,913	3,416	3,942	2,353			
1985	15,965	6,618	9,330	5,163	3,823	4,348	3,018	2,672		
1984	16,530	7,063	9,905	5,531	4,209	5,072	3,505	3,215	4,256	
1983	18,834	8,661	11,672	7,058	5,170	6,275	4,875	4,016	4,860	4,848

Source: Medicare Cost Reports.

Given their fewer discharges and, in some years, roughly similar days of care with respect to similar open hospitals, it is not surprising to find higher average lengths of stays for closed hospitals than for open ones. Hospitals that closed in 1988 average higher lengths of stay in all five years preceding closure than open hospitals, and the difference is even more pronounced between the more similar small open hospitals and closed hospitals (see Table 4-11). This is particularly true for the immediate three years prior to closure when patients stayed 1 day longer (on average) in hospitals that were soon to close than they did in small rural hospitals that remained open. The same pattern can be seen looking at Medicare lengths of stay in Table 4-12.

Not surprisingly, occupancy rates are also lower for closed hospitals in the years prior to closure than they are even for small rural hospitals that remained open. In addition, occupancy rates are lower in the year immediately prior to closure for more recent closures. For example the average occupancy rate for hospitals closing in 1987 through 1989 was less than 30 percent in the year prior to closing, compared to 38 and 34 percent for 1984 and 1985 closures (see Table 4-13).

Table 4-14 shows the proportion of Medicare discharges for open and closed hospitals by year. Although, the proportion of Medicare discharges often decreases prior to closure, the actual proportions are not consistently different between open and closed hospitals in the years prior to closure.

4.6 Summary

Between 1980 and 1989, 232 rural hospitals closed and 232 urban hospitals closed. The analysis of Chapter 3.4 suggests that PPS did not start affecting the number of hospital closures until 1986. Between 1986 and 1989, there were 21 percent more rural hospital closures than urban hospital closures. In addition, for the entire period from 1980 to 1989, rural hospitals were slightly more likely to close that urban hospitals (Table 4-2). Sole community hospitals and hospitals with the rural referral center designation were less likely to close than rural hospitals that did not qualify for these designations.

TABLE 4-11

MEAN LENGTH OF STAY (ALL INPATIENTS), CLOSED HOSPITALS (1984-1989) AND HOSPITALS WHICH REMAINED OPEN BETWEEN 1980 AND 1989

	HOSPITALS THAT REMAINED OPEN									
		Hospitals With Less Than 200 Beds			Year in Which Hospital Closed					
Year	All	All	Urban	Rural	1989	1988	1987	1986	1985	1984
1988	5.36	4.94	5.53	4.62	5.58					
1987	5.40	4.96	5.52	4.66	5.45	5.67				
1986	5.38	4.94	5.47	4.66	5.42	5.46	5.11			
1985	5.40	4.94	5.44	4.68	5.75	5.77	5.07	5.41		
1984	5.61	5.12	5.63	4.84	5.41	5.61	5.46	5.76	5.15	
1983	6.26	5.79	6.25	5.55	6.31	6.32	6.34	6.03	6.26	6.27

Source: Medicare Cost Reports.

TABLE 4-12

MEAN MEDICARE INPATIENTS' LENGTH OF STAY, CLOSED HOSPITALS (1984-1989) AND HOSPITALS WHICH REMAINED OPEN BETWEEN 1980 AND 1989

	HOSPITALS THAT REMAINED OPEN									
		Hospitals With Less Than 200 Beds			Year in Which Hospital Closed					
Year	All	All	Urban	Rural	1989	1988	1987	1986	1985	1984
1988	7.49	6.80	7.33	6.51	7.00					
1987	7.47	6.77	7.34	6.46	7.31	7.31				
1986	7.43	6.75	7.34	6.43	7.22	7.30	6.82			
1985	7.42	6.69	7.28	6.38	7.13	7.23	6.78	6.92		
1984	7.30	6.55	7.28	6.16	6.62	7.18	6.40	7.03	6.91	
1983	8.42	7.74	8.39	7.40	7.98	8.45	7.99	8.09	8.53	7.73

Source: Medicare Cost Reports.

TABLE 4-13

MEAN OCCUPANCY RATE (ALL INPATIENTS), CLOSED HOSPITALS (1984-1989) AND HOSPITALS WHICH REMAINED OPEN BETWEEN 1980 AND 1989

	HOSPITALS THAT REMAINED OPEN									
		Hospitals With Less Than 200 Beds			Year in Which Hospital Closed					
Year	All	All	Urban	Rural	1989	1988	1987	1986	1985	1984
1988	47.1%	38.7%	46.9%	34.3%	23.8%					
1987	47.5	39.4	47.2	35.2	27.7	27.6%				
1986	48.0	40.3	47.8	36.2	27.7	32.7	23.5%			
1985	49.5	42.2	49.4	38.4	29.8	35.5	29.0	29.4%		
1984	53.0	46.0	53.2	42.2	33.7	39.8	34.9	35.0	33.5%	
1983	59.7	54.0	60.0	50.8	42.4	47.2	42.3	42.3	41.5	37.8%

Source: Medicare Cost Reports.

TABLE 4-14

MEAN MEDICARE DISCHARGES AS A PERCENTAGE OF ALL INPATIENT DISCHARGES, CLOSED HOSPITALS (1984-1989) AND HOSPITALS WHICH REMAINED OPEN BETWEEN 1980 AND 1989

	HOSPITALS THAT REMAINED OPEN									
		Hospitals With Less Than 200 Beds			Year in Which Hospital Closed					
Year	All	All	Urban	Rural	1989	1988	1987	1986	1985	1984
1988	38.6%	41.1%	37.0%	43.3%	46.2%					
1987	37.8	40.0	36.4	41.9	42.2	40.3%				
1986	37.0	39.2	35.7	41.1	42.5	37.2	39.2%			
1985	37.0	39.2	35.7	41.1	43.1	39.3	40.9	38.3%		
1984	37.4	39.5	36.5	41.1	42.1	37.9	42.1	40.5	34.9%	
1983	38.2	40.1	36.7	41.9	44.6	38.7	43.2	38.6	37.2	48.2%

Source: Medicare Cost Reports.

Smaller hospitals, both rural or urban, were more likely to close than larger hospitals. Although there are fewer proprietary hospitals than either voluntary or public hospitals, proprietary hospitals have a disproportionately large share of the hospital closures. This result suggests that because proprietary hospitals must satisfy stockholders, proprietary hospitals are less likely to try to stay open in the face of continuing or prospective losses than not-for-profit hospitals.

Hospitals with the highest shares of Medicaid admissions have a disproportionately large share of the hospital closures between 1980 and 1989. One-fourth of the hospitals that remained open had a Medicaid share of admission exceeding 11.18 percent while 38 percent of the hospitals that closed had a Medicaid share that exceeded 11.18 percent. While not conclusive, this result suggests that poor people may have reduced access to care because of hospital closures. This possibility is partially supported by the data in Table 4-5 which shows that hospital closures occurred in counties with high proportions of poor people.

Like all hospitals, hospitals which closed between 1980 and 1989 experienced declining inpatient volume. Hospitals that closed, however, had larger inpatient volume losses than hospitals which remained open. Table 4-14 shows, for the period 1983 through 1988, that the Medicare share of admissions for closed hospitals was similar to open hospitals. The Medicare share of admissions, thus, does not appear to be a factor associated with either remaining open or closing.

5.0 HOSPITAL COSTS, REVENUES, AND PROFITABILITY PRIOR TO CLOSURE

In Chapter 4, evidence was provided that hospitals which closed between 1984 and 1989 experienced declining discharges (admissions), inpatient days, and occupancy rates. Not only did the patient volume of closed hospitals decline in absolute numbers, but also relative to the volume of hospitals that remained open. For instance, hospitals that closed in 1988 had, in 1983, mean discharges which were 69 percent of the mean discharges of hospitals that remained open; by 1987, the ratio fell to 53 percent.

How did the absolute and relative inpatient volume declines of hospitals that closed affect the ability of the hospital to remain open? The purpose of this chapter is to examine what happened to average costs, revenue per case, and profitability of hospital that closed (1984-89) and hospitals which remained open. In Section 5.1, the theoretical linkage between inpatient volume and average costs is briefly reviewed. Section 5.2 discusses the data used to examine the financial experience of hospitals. Costs, revenues, and profitability, are respectively, the subjects of Sections 5.3, 5.4, and 5.5.

5.1 Average Costs and Volume

It is a well-known empirical finding there are economies of scale in the production of hospital services. This result implies that, other things equal (e.g., bedsize), costs per discharge (inpatient day) are lower in hospitals with high volume than in hospitals with low volume. This implies, in turn, given the findings in Chapter 4 that indicated that patient volume was lower in closed hospitals than in hospitals which remained open, that costs per discharge were higher in hospitals which closed than in hospitals which remained open.

An additional prediction about the average costs of closed hospitals relative to open hospitals can be made: that costs per discharge of closed hospitals increased at a higher rate than costs per discharge of open hospitals. First, this prediction is partly based on the empirical finding economies of scale exist and on the assumption of a smoothly downward-sloping average cost curve. Second, volume declines in closed hospitals moved these hospitals into relatively steeper sections of the cost curve than the volume declines

of open hospitals. Third, the evidence provided in Chapter 4 indicates that closed hospitals experienced larger percentage declines in patient volume than hospitals that remained open. Thus, taken together, these three points imply that costs per discharge of closed hospitals increased at a higher rate than costs per discharge of open hospitals.

5.2 Data

The basic data on hospitals that closed and those that remained open comes from CHER's Universe file. The primary information on each hospital in the Universe file, including a hospital identification code, was obtained from annual surveys of hospitals conducted by the American Hospital Association (AHA) -- see Chapter 2 for details. Because the AHA does not release revenue data obtained in the surveys, other sources of data are necessary. In this chapter, utilization, cost, and revenue data were obtained from Medicare Cost Reports for the years 1983-88. (See the extended discussion in Chapter 4.4.)

5.3 Cost per Inpatient Discharge

Costs per (all) inpatient discharge were generally higher in hospitals which closed (1984-89) than in hospitals which remained open. For instance, hospitals which closed in 1989 had, on average, 29 percent higher costs per discharge during 1988 than hospitals with less than 200 beds that remained open (Table 5-1). All of the ratios of costs per discharge were greater than one (1.0) for the year immediately prior to closure, two years prior to closure, and for 1983. All values in Table 5-1 were obtained by dividing the mean (unweighted) value of closed hospitals by the corresponding mean (unweighted) value of hospitals with less than 200 beds that remained open. The means used in these calculations came from Tables 5-2 through 5-5; the 29 percent figure cited above was obtained by dividing $3,773 by $2,936 (Table 5-2).

The actual means of cost per (all) inpatient discharge are shown in Table 5-2. The rows the table indicate the year in which the costs were incurred. Note that the rows start with 1988 and go down to 1983. The last six columns represent the years in which hospitals closed. For

TABLE 5-1

CHARACTERISTICS OF CLOSED HOSPITALS RELATIVE TO OPEN HOSPITALS (WITH 200 OR FEWER BEDS), ONE AND TWO YEARS BEFORE CLOSURE

Operating Characteristics and Time Period Before Closure	Ratio of Closed to Open Hospitals' Values by Year of Closure					
	1989	1988	1987	1986	1985	1984
Cost Per Discharge						
One Year Before	1.29	1.21	1.39	1.20	1.06	1.06
Two Years Before	1.32	1.13	1.25	1.16	1.06	N/A
1983	1.03	1.10	1.17	1.05	1.06	1.06
Cost Per Medicare Discharge						
One Year Before	1.16	1.18	1.21	1.05	1.09	1.04
Two Years Before	1.12	1.16	1.14	1.17	1.09	N/A
1983	.94	1.12	1.11	1.10	1.09	1.04
Inpatient Revenue Per Discharge						
One Year Before	1.05	1.03	1.22	1.05	.83	N/A
Two Years Before	1.11	1.09	1.16	.99	N/A	N/A
1984	1.15	1.08	1.06	.99	.83	N/A
Revenue Per Medicare Discharge						
One Year Before	.93	1.04	1.07	.92	.97	N/A
Two Years Before	.98	1.06	1.01	1.02	N/A	N/A
1984	1.00	1.05	1.02	1.02	.97	N/A

Note: N/A: Not Available

The ratios are calculated from the values reported in Tables 5-2 through 5-5. The denominator is the value for All Open Hospitals with less than 200 beds. The numerator is the corresponding value for closed hospitals.

TABLE 5-2

MEAN (UNWEIGHTED) COST PER DISCHARGE (ALL INPATIENTS), CLOSED HOSPITALS (1984-1989) AND HOSPITALS WHICH REMAINED OPEN BETWEEN 1980 AND 1989

	HOSPITALS THAT REMAINED OPEN									
		Hospitals With Less Than 200 Beds			Year in Which Hospital Closed					
Year	All	All	Urban	Rural	1989	1988	1987	1986	1985	1984
1988	$3,297	$2,936	$3,709	$2,531	$3,773					
1987	3,019	2,665	3,335	2,309	3,524	$3,231				
1986	2,742	2,417	3,000	2,104	2,926	2,736	$3,361			
1985	2,501	2,190	2,693	1,923	2,823	2,558	2,733	$2,633		
1984	2,307	2,001	2,481	1,744	2,232	2,173	2,376	2,321	$2,128	
1983	2,138	1,870	2,352	1,630	1,931	2,066	2,186	1,965	1,983	$1,982
Mean Annual Change[a]	8.7%	9.0%	9.1%	8.8%	13.4%	11.2%	14.3%	14.6%	7.1%	N/A

[a]For hospitals that remained open: 1983-88; for hospitals that closed: year prior to closure and 1983.

Note: N/A: Not Available

Source: Medicare Cost Reports.

a hospital that closed in 1988, its cost per discharge in 1987 was $3,231, in 1986 it was $2,736, in 1985 it was $2,558, in 1984 it was $2,173, and in 1983 its cost per discharge was $2,066. Thus, to find the mean cost of discharge of hospitals that closed, find the column for the year of closure and then go down to the appropriate year row to obtain the mean cost. None of the cost data was adjusted for the patient mix nor any other factor. As explained in Section 5.2, utilization, cost, and revenue data for the year in which the hospital closed are considered unreliable and thus there is no entry in the 1988 row for hospitals that closed in 1988. The last row in Table 5-2 shows the mean annual percentage change from 1983 to 1988 for hospitals which remained open and from 1983 to the year prior to closure for hospitals which eventually closed.

The first four columns of Table 5-2 represent those hospitals which remained open between 1980 and 1989. The hospitals which remained open are the reference group to which comparisons are made with the closed hospitals. In 1986, the mean cost per discharge for all open hospitals was $2,742. For hospitals which closed in 1988, mean cost per discharge in 1986 was $2,736. This would seem to indicate that hospitals which closed were less expensive than those which remained open. However, most hospitals that closed had less than 200 beds. Thus, instead of all hospitals that remained open which include very large hospitals that purchase expensive medical equipment such as magnetic resonance imagers, the reference group should be all hospitals with less than 200 beds that remained open. For hospitals with less than 200 beds that remained open, mean cost per discharge in 1986 was $2,417 which is lower than the mean cost of closed hospitals in 1986. For all tables in Chapter 5, unless otherwise specified, the reference group of open hospitals are <u>all</u> those with less than 200 beds (column 2); the other columns for the open hospitals are presented for information purposes only.

In addition to being more costly than hospitals which remained open, closed hospitals experienced larger percentage increases in cost per discharge (except for 1985). For instance, compared to hospitals which remained open, hospitals that closed in 1988 had 21 percent higher costs during 1987 and 10 percent higher costs during 1983 (Table 5-1). This indicates that, relative to hospitals which remained open, hospitals which closed were experiencing greater difficulties in controlling costs before the implementation of the Prospective Payment

System (PPS). One reason closed hospitals had difficulties in controlling inpatient costs was due to low inpatient volume. However, since capital costs are included in the calculations, it is likely that the problem of controlling costs was not entirely due to a lack of control of current costs.

For any given year, costs per Medicare discharge for hospitals which eventually closed were also greater than for hospitals which remained open. In addition, relative to hospitals which remained open, costs per Medicare discharge often increased at a higher rate for hospitals which eventually closed. For instance, compared to hospitals which remained open, hospitals that closed in 1988 had 18 percent higher costs during 1987 and 12 percent higher costs during 1983 (Table 5-1).

It appears, however, that costs per Medicare discharge did not increase as much as did costs per discharge for all inpatients. For hospitals which closed in 1988, the cost per (all) inpatient discharge increased from $2,066 in 1983 to $3,231 in 1987, an average annual increase of 11.2 percent (Table 5-2) while the cost per Medicare discharge rose from $2,677 in 1983 to $3,809 in 1987, an average annual increase of 8.8 percent (Table 5-3).

The only exceptions to the preceding conclusions are for the years 1984 and 1985. As explained in Section 5.2, there were relatively few hospitals which closed during these two years for which any Medicare Cost Report data was available. Thus, the ratios reported in Table 5-1 may not be indicative of the experience of all hospitals which closed in 1984 and 1985.

5.4 Revenue per Discharge

For hospitals which closed in 1988, the revenue per (all) inpatient discharge was $3,244 in 1987 (Table 5-4). For hospitals which remained open, the revenue per (all) inpatient discharge was $3,149 in 1987. For hospitals which closed in 1988, the revenue per Medicare discharge was $3,318 in 1987 (Table 5-5). For hospitals which remained open, the revenue per Medicare inpatient discharge was $3,190 in 1987. Thus, like costs, for any given year, revenue per discharge was often higher in hospitals which eventually closed than in hospitals which remained open. And, although more costly per discharge than for open hospitals, hospitals

TABLE 5-3

MEAN (UNWEIGHTED) COST PER MEDICARE DISCHARGE, CLOSED HOSPITALS (1984-1989) AND HOSPITALS WHICH REMAINED OPEN BETWEEN 1980 AND 1989

	HOSPITALS THAT REMAINED OPEN									
		Hospitals With Less Than 200 Beds			Year in Which Hospital Closed					
Year	All	All	Urban	Rural	1989	1988	1987	1986	1985	1984
1988	$4,101	$3,479	$4,549	$2,907	$4,041					
1987	3,785	3,215	4,178	2,696	3,596	$3,809				
1986	3,466	2,944	3,806	2,480	3,467	3,429	$3,560			
1985	3,181	2,686	3,446	2,277	2,936	2,959	3,060	$2,828		
1984	2,881	2,427	3,085	2,072	2,498	2,674	2,647	2,841	$2,648	
1983	2,785	2,385	3,080	2,015	2,243	2,677	2,658	2,621	2,609	$2,471
Mean Annual Change[a]	7.7%	7.6%	7.8%	7.3%	11.8%	8.8%	9.7%	3.8%	1.5%	N/A

[a]For hospitals that remained open: 1983-88; for hospitals that closed: year prior to closure and 1983.

Note: N/A: Not Available

Source: Medicare Cost Reports.

TABLE 5-4

MEAN (UNWEIGHTED) REVENUE PER DISCHARGE (ALL INPATIENTS), CLOSED HOSPITALS (1985-1989) AND HOSPITALS WHICH REMAINED OPEN BETWEEN 1980 AND 1989

	HOSPITALS THAT REMAINED OPEN									
		Hospitals With Less Than 200 Beds			Year in Which Hospital Closed					
Year	All	All	Urban	Rural	1989	1988	1987	1986	1985	1984
1988	$4,067	$3,506	$4,513	$2,978	$3,685					
1987	3,672	3,149	4,074	2,657	3,489	$3,244				
1986	3,339	2,862	3,682	2,420	3,255	3,124	$3,479			
1985	3,116	2,637	3,412	2,226	3,120	2,891	3,046	$2,760		
1984	2,936	2,486	3,241	2,078	2,870	2,675	2,645	2,452	$2,070	
1983	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mean Annual Change[a]	8.1%	8.6%	8.3%	9.0%	6.2%	6.4%	13.7%	11.8%	N/A	N/A

[a]For hospitals that remained open: 1984-88; for hospitals that closed: year prior to closure and 1984.

Note: N/A: Not available; 1983 revenue not calculated because of missing data elements.

Source: Medicare Cost Reports.

TABLE 5-5

MEAN (UNWEIGHTED) REVENUE PER MEDICARE DISCHARGE, CLOSED HOSPITALS (1985-1989) AND HOSPITALS WHICH REMAINED OPEN BETWEEN 1980 AND 1989

	HOSPITALS THAT REMAINED OPEN									
		Hospitals With Less Than 200 Beds			Year in Which Hospital Closed					
Year	All	All	Urban	Rural	1989	1988	1987	1986	1985	1984
1988	$4,027	$3,370	$4,525	$2,759	$3,142					
1987	3,826	3,190	4,301	2,603	3,121	$3,318				
1986	3,630	3,019	4,076	2,459	2,933	3,194	$3,217			
1985	3,441	2,900	3,926	2,384	2,953	3,035	2,917	$2,673		
1984	3,138	2,652	3,548	2,204	2,654	2,780	2,698	2,697	$2,579	
1983	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mean Annual Change[a]	6.2%	6.0%	6.1%	5.6%	4.2%	5.9%	8.8%	-0.9%	N/A	N/A

[a]For hospitals that remained open: 1984-88; for hospitals that closed: year prior to closure and 1984.

Note: N/A: Not available; 1983 revenue not calculated because of missing data elements.

Source: Medicare Cost Reports.

which eventually closed received higher reimbursement per discharge than hospitals which remained open.*

The rate of increase of revenue per discharge for hospitals which eventually closed did not always increase less than for hospitals which remained open. Hospitals which closed in 1988 had eight percent higher revenue per case in 1984 than did hospitals which remained open (Table 5-1). By 1987, however, the differential was only three percent. On the other hand, hospitals which closed in 1987 had six percent higher revenue per case in 1984 than did hospitals which remained open (Table 5-1). By 1987, however, the differential increased to 22 percent. The relative rates of increase of revenue per Medicare discharge for hospitals which remained open to those which eventually closed were also mixed (Table 5-1).

Despite declining patient volume (Tables 4-6 through 4-12), Tables 5-4 and 5-5 indicate that hospitals which eventually closed received increased revenue per case. Given that these hospitals eventually closed, it would appear that it was not enough to offset the increasing costs per discharge.

5.5 Profitability

With the advent of PPS, hospitals were allowed to legitimately profit from serving Medicare beneficiaries. Median profit margins from serving Medicare inpatient beneficiaries are shown in Table 5-6. The profit margin was calculated by dividing total Medicare profit on inpatient services by Medicare reimbursement for inpatient services. Because mean profit margins are very sensitive to extreme outliers, median values are presented in their place (as is commonly done in financial analysis). Because revenue values could not be calculated for the year 1983, profit margins are not available for 1983.

Medicare profit margins, except for hospitals which closed in 1985 and 1986, were positive during the first year of PPS. However, median Medicare profit margins in hospitals which eventually closed were always lower than in hospitals which remained open. The median profit margins of hospitals which eventually closed fell much faster than for those

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*Not all of data elements were available on the HCRIS extracts of Medicare Cost Reports to construct revenue values for 1983.

TABLE 5-6

MEDIAN MEDICARE INPATIENT PROFIT MARGIN, CLOSED HOSPITALS (1985-1989) AND HOSPITALS WHICH REMAINED OPEN BETWEEN 1980 AND 1989

	HOSPITALS THAT REMAINED OPEN									
		Hospitals With Less Than 200 Beds			Year in Which Hospital Closed					
Year	All	All	Urban	Rural	1989	1988	1987	1986	1985	1984
1988	.33%	-.18%	1.16%	-1.05%	-14.71%					
1987	2.97	1.71	4.67	.02	-9.63	-11.09%				
1986	5.60	3.89	7.24	1.83	-4.54	-5.89	-17.21%			
1985	9.77	8.35	12.53	6.23	2.49	3.36	-1.68	-2.28%		
1984	9.97	8.89	12.29	7.06	6.36	8.11	2.85	-.25	-6.86%	
1983	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note: N/A: Not available; 1983 profit margins not calculated because of missing data elements needed for revenue.

Source: Medicare Cost Reports.

hospitals which remained open. The median profit margin for hospitals which closed was always negative the year prior to closure. More than half of the hospitals which closed between 1989 and 1987 had costs which exceeded revenues by more than 10 percent during the year prior to closure. And more than half of the hospitals which closed between 1989 and 1986 had costs which exceeded revenues two years prior to closure.

Median profit margins on all patient services exhibited the same basic trends (Table 5-7) as the median Medicare profit margins.* Hospitals which closed had negative profits at least one year prior to closure. Unlike Medicare profit margins, however, overall profit margins for hospitals which remained open continued to be positive during 1987 (PPS-4) and 1988 (PPS-5).**

5.6 Conclusions

Inpatient volume declines affected most hospitals after PPS was implemented. The volume declines were greater for hospitals that eventually closed than for hospitals which remained open. Simultaneously, costs per discharge rose faster in hospitals which eventually closed than in hospitals which remained open. And, hospitals which eventually closed received higher reimbursement per discharge than hospitals which remained open. However, the cost pressures that seem to be due to declining volume caused profit margins to continuously fall in hospitals which closed. More than half of the hospitals which closed experienced negative profit margins at least one year prior to closure.

More than half of the hospitals which closed between 1985 and 1989 experienced positive profits from serving Medicare beneficiaries during the first year of PPS. However,

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*Overall profit margins were calculated by dividing total profit on all patient services by total revenues received for all patients services. See the companion report on PPS profits (Cromwell and Burge, 1991) for details on the construction of both of the profit margins utilized in this report.

**Unlike the profit margins presented in a companion report (Cromwell and Burge, 1991), the profit margins presented in Tables 5-6 and 5-7 are medians rather than means and both medians are based on unweighted calculations. The reason medians are used is because of the small number of closures in any given year. Means are too sensitive to extreme values of outliers.

TABLE 5-7

MEDIAN TOTAL PATIENT SERVICES PROFIT MARGIN, CLOSED HOSPITALS (1985-1989) AND HOSPITALS WHICH REMAINED OPEN BETWEEN 1980 AND 1989

	HOSPITALS THAT REMAINED OPEN									
		Hospitals With Less Than 200 Beds			Year in Which Hospital Closed					
Year	All	All	Urban	Rural	1989	1988	1987	1986	1985	1984
1988	6.25%	5.69%	7.05%	4.82%	-23.62%					
1987	6.84	6.01	7.90	4.86	-11.68	-15.28%				
1986	7.70	6.35	8.94	4.72	-5.10	-4.32	-16.19%			
1985	8.72	7.58	10.92	5.81	-.36	2.66	-3.55	-7.31%		
1984	9.54	8.38	11.35	6.49	2.16	2.70	-2.69	-.71	-5.58%	
1983	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note: N/A: Not available; 1983 profit margins not calculated because of missing data elements needed for revenue.

Source: Medicare Cost Reports.

it is well known that hospital profit margins for all hospitals were at record highs during the first two years of PPS. Thus, it would seem that the low volumes of the hospitals which eventually closed had prior to PPS would have put many of them at risk of closure even if PPS had not been implemented.

6.0 A MULTIVARIATE ANALYSIS OF HOSPITAL CLOSURES

Evidence was provided in the previous two chapters that, compared to hospitals which remained open the entire period of 1980 through 1989, hospitals which closed between 1985 and 1989 had lower inpatient volume for any given year, larger percentage declines in inpatient volume, lower profit margins for any given year, and larger declines in profitability. It is almost a truism that poor economic performance by a firm, in any industry, leads to the firm's exit from the industry. A major question is why specific firms (hospitals) experience poor performance.

There are several reasons why firms experience poor economic performance which leads to exit from an industry. Poor or ineffective management is one reason. Ineffective management can manifest itself through its inability to control costs and/or exploit market opportunities. Another reason is that the industry is declining (shrinking markets) and that some firms will have to exit before market equilibrium is re-established. Which firms (hospitals) first exit a declining industry is the subject of this chapter.

A model of hospital closures is developed in Section 6.1. Data sources and the methodology used to test the model are the subjects of Section 6.2. The variables used to test the model are discussed in Section 6.3. Probit regression results on hospitals that closed between 1985 and 1989 are discussed in Section 6.4 and Section 6.5 summarizes the chapter.

6.1 An Economic Model of Hospital Closures

This section is divided into two parts. The first part describes the basic financial constraint facing a hospital. The second part describes the basic determinants of the financial constraint.

6.1.1 The Basic Model

A few theoretical models of industry exit have been developed (Jovanovic, 1982). The main prediction of Jovanovic's model and its derivatives is that smaller and/or younger firms will be the first to exit the industry. While these theoretical models are very general, the empirical testing of the models, assume a national market for the industry's output with the

result that local markets are essentially ignored (e.g., Dunne, Roberts, and Samuelson, 1988, 1989a, 1989b; Evans, 1987a, 1987b; and Hall, 1987).

One problem with Jovanovic's model is that it does not directly consider future profitability of the firm or industry. Ghemawat and Nalebuff (1985) developed a model in which the individual future profitability of each of the incumbent firms and the total future profits available in the market (industry) are considered. Ghemawat and Nalebuff demonstrate that larger firms rather than smaller firms are the first in a market (either duopoly or oligopoly) to exit. An exception to their basic finding is that larger firms that have cost advantages due to overwhelming economies of scale may be the last to exit.

To obtain their results, Ghemawat and Nalebuff make several assumptions which, however, are not applicable to the hospital industry. First, they assume a single homogenous output which is produced by each firm. Second, production of the output is not technically feasible at very low rates of capacity utilization. Finally, they implicitly assume that all firms are for-profit. Even though Ghemawat and Nalebuff's model cannot be directly used, their central idea about the importance of the future profitability of individual firms is employed in the analysis in this chapter. (The paper by Redmon (December 1990) and the companion GAO report (June 1990) are multivariate analyses of hospital closures. Neither of these two papers developed a model of hospital closures.)

One simple model of hospital behavior would be to specify a hospital utility function which is maximized subject to a financial constraint. For instance, a hospital's utility function could be dependent on the quantity and quality of services produced subject to the constraint that the hospital break-even. However, because the concern of this chapter is how the financial constraint affects closures, the hospital's utility function is ignored.

In essence, if a hospital's expected future profits are greater than or equal to a profitability target, the hospital remains open; otherwise it closes. The hospital's expected future profits can be decomposed into three categories. The first is the expected profits, $E(\pi_p)$, from producing patient care (p) services. The second category is the expected profits, $E(\pi_n)$, from producing nonpatient care (n) services. The final "profitability" category consists of expected "gifts," E(G), from the community.

The first category of expected future profits consists of those profits derived directly from producing inpatient, outpatient, long-term care services, and other miscellaneous services such home health agency services. The second category consists of profits derived from nonpatient care services such as parking, flower shops, and other profit-making services owned by the hospital or its parent organization. These profits are used to augment the financial resources of the hospital. These profits may not exist in the absence of a hospital. For instance, a parking structure may not have any value to the rest of the community in the absence of a hospital. Nor would it be likely that a hospital's flower shop would be able to compete with normal retail florists. Although the profitability of nonpatient care services may not be directly tied to the profitability of patient care services, it may be dependent on the volume of hospital patients.

The third category consists of gifts (grants) from the community. For instance, local government tax revenues are often used to subsidize local hospitals. Other types of "gifts" in this category include contributions from religious organizations, proceeds of fund-raising drives, and outright grants from individuals and corporations. Also included in this category is the monetary equivalent of in-kind donations of land, volunteer labor, and other supplies. Some organizations may make their annual gifts contingent on the size of the hospital's profit in a given year. For instance, local governments might provide a subsidy in a given year only if the hospital was losing money in the given year. If organizations make their gifts contingent on the size of hospital profits, then there would be an endogeneity problem if gifts were included in the financial constraint. One way to avoid the endogeneity problem would be to stipulate that the hospital's expected gifts represent the maximum value of the gifts obtainable from the community.

Although not a crucial assumption, it is assumed that the planning horizon for the hospital's closure/remain open decision is relatively short. For instance, the typical hospital may only consider the next five years. The hospital discounts expected future profits and gifts back to the decision date. (For any given hospital, there could be a decision each year whether to continue providing hospital services.)

In addition to discounted expected profits from the future production of hospital services, a hospital's previous debts (e.g., long-term debt) may affect the hospital's financial constraint. A large previous debt might be sufficiently large such that positive expected future profits might not be enough to ensure remaining open. The reason that positive discounted profits may not be sufficient to keep a hospital open is because of the possibility of annual variation of profits. Two or three years of consecutive operating losses (including interest payments) could be a problem for hospitals that are highly leveraged. (One measure of financial leverage is the ratio of long-term debt to total net assets.) A higher degree of financial leverage, ceteris paribus, implies higher fixed costs. If actual output (patient volume) or revenue falls short of projected targets, then the percentage decline in profits is greater than the percentage shortfall in output (revenue). It is well known that highly leveraged firms tend to have a greater variation in profitability than firms that are less leveraged.

The remain open/close decision can be stated in functional form as:

$$O/C = f(E(\pi_p), E(\pi_n), E(G), TD)$$

where TD represents total previous debt. Let O/C be measured by a binary variable with:

0 = remaining open (no change)
1 = closing

The decision rule whether to remain open or to close can be summarized as:

$$O/C = 0 \text{ if } E(\pi_p) + E(\pi_n) + E(G) \geq \Pi$$
$$= 1 \text{ otherwise}$$

where Π represents the critical profit value by which the organization decides whether to continue operations or close. Included in Π is a portion of the total debt that is not amortized over the planning period. It should be noted that Π need not be the same value for all hospitals; for instance, Π may vary systematically by ownership class.

6.1.2 Determinants of Hospital Performance

As noted above, it is almost a truism that hospitals which cannot achieve their minimum financial goals close. To turn the above model into a behavioral model, hospital profit on patient services is first decomposed into its main constituents. Next, the determinants of the constituents of profits are described. Since many of the factors which affect hospital profits on patient services also affect profits on nonpatient care services and gifts, the discussion will focus on the profits from patient care services.

Hospital profit, π, can be decomposed into total revenue (TR) and total costs (TC):

$$\pi = TR - TC.$$

Total revenue and total costs can be further decomposed as follows:

$$TR = P * ADM$$
$$TC = (Cost/ADM) * ADM$$

where ADM is hospital admissions, P is the average price "charged" per admission, and (Cost/ADM) is the average cost per admission. (In order to simplify the analysis, it is assumed that all admissions are paid on a case basis as under PPS. In addition, outpatient visits are aggregated into admission equivalents.)

The total revenue equation embodies the demand curve for hospital services. Although some payers, notably PPS, pay a fixed prospective rate per admission, other payers pay costs or charges. It is assumed that the other payers are price sensitive such that at least part of the market demand curve for hospital services is downward sloping. It is also assumed that each hospital faces a downward-sloping demand curve for its services. (Local markets are assumed to be characterized by one of the following situations: monopoly, oligopoly, or monopolistic competition.) The total cost equation embodies the average cost per admission. Following (partially) Sloan and Steinwald (1980), the demand for hospital services is:

$$P = P(ADM, Y; M)$$

where Y is the quality of care rendered (service intensity) and M represents exogenous demand determinants. Average costs can be expressed as:

$$AC = AC(ADM, Y; N)$$

where N represents exogenous determinants of costs. It is the purpose of this section to describe the determinants of demand and average costs, M and N respectively.

The demand for hospital services is a function of the size of the market (for example, total population), the economic well-being of the market's population (for example, per capita income, health insurance coverage, and unemployment rate), and the supply of physicians. A hospital's average costs are a function of capacity of the hospital (for example, staffed beds), the price of labor, the case mix of patients served, and, possibly, the ownership of the hospital. The actual variables used to represent these broad categories of demand and cost determinants in the hospital closure regressions are discussed in Section 6.3.

6.2 Data Sources and Methodology

6.2.1 Data Sources

There are four primary sources from which data was acquired to construct the analytical data file. The first source of data is CHER's universe file which tracks hospital closures, openings, mergers, and other changes in hospital status. In addition to tracking changes of hospital status, it also tracks hospital ownership, primary service (that is, whether it is a general medical and surgical hospital), a member of a hospital system (chain), and the number of staffed beds. Also included on the universe file is a measure of the competitiveness of a market area, the Herfindahl index. The construction of the universe file was described in Chapter 2 of this report.

The second source of data are the annual surveys conducted by the American Hospital Association (AHA). As noted in Chapter 2, AHA data is the primary source for many variables on CHER's universe file. AHA data, however, is not always current. CHER, therefore, while updating its universe file, reviewed and/or corrected anomalous values of beds, et cetera.

The third major source(s) of data are Medicare Cost Reports from 1983 (TEFRA) through 1988 (PPS 5), PPS area wage indices for 1984 and 1988, MEDPAR data, and HCFA's "impact" file. Medicare Cost Reports are the source of each hospital's utilization variables as well as revenue, costs, long-term debt, total net assets, and profit margins. MEDPAR data was used by Abt Associates to construct a Medicare case mix index based on DRG cost weights for payment periods TEFRA (1983) through PPS 3 (1986). CHER updated the Medicare case mix index through PPS 5 (1988). The impact file is the source of PPS payment adjustment indicators for sole community hospitals, rural referral centers, and teaching status.

The Medicare Cost Report (MCR) data was linked to the basic AHA records for each hospital. It was not possible, however, to find a MCR record for each AHA record, particularly among closed hospitals. Of the 318 hospitals which closed between 1985 and 1989, it was not possible to find any MCR record (for any year) for 36 hospitals. The year for which there was the worst problems (percentage-wise) in obtaining a match was 1985: 8 of the 42 hospitals were without any MCR data. One possible reason that data was not available for the hospitals that closed in 1985 is that they did not file Medicare Cost Reports (many of which might have been for fiscal year starting in 1984 rather than 1985). Of the remaining 28 hospitals for which a record could not be found, there are two likely reasons. First, some of the hospitals which CHER defines as a short-term, acute-care general hospital are considered by HCFA as PPS exempt hospitals and thus such records were not available to CHER. Second, there were a number of instances in which there were either multiple AHA records for a single MCR provider id or multiple MCR records for a given AHA hospital id. Because of a severe time constraint, no attempt was made to reconcile the above problem of multiple records. (See the extended discussion in Chapter 4.4.)

The last major source of data is the Area Resource File (ARF). The ARF is the source of population characteristics, the population's income, physician supply, unemployment rates, and poverty rates.

6.2.2 Methodology

The analytic data set consists of a "cross section" of hospitals. There are two groups of short-term, acute-care hospitals in the data set. The first group consists of those hospitals

which closed between 1985 and 1989 (inclusive). The second group consists of hospitals which remained open between 1980 and 1989. Excluded from the data set are hospitals that were newly opened during the 1980s, involved in mergers within the same market, changed status from acute care to specialty status, or changed from specialty status to acute care status. The market for urban hospitals is defined as the MSA in which the hospital is located. The market for rural hospitals is defined as the county in which the hospital is located.

There are two major reasons why the group of closed hospitals is restricted to the period 1985-89. First, as noted in Chapter 5 and in the previous section, there are problems with missing MCR data for 1983 and 1984. Second, the quality of data for the year of closure is often unreliable; therefore values from one or two years prior to closure are considered more reliable.

The dependent variable is a 0,1 binary variable with 0 denoting hospitals which remained open and 1 denoting hospitals which closed. Independent variables include, as discussed in Section 6.1.2, the determinants of hospital revenues and costs. Ordinary least squares (OLS) regressions might yield individual predicted probabilities of closure less than zero or greater than one. OLS linear probability models also suffer from heteroscedasticity. Therefore, the regression is estimated using a non-linear maximum likelihood procedure: probit. (Logit regressions, for cost reasons, are sometimes used instead of probit. The two procedures given similar results.)

The model presented in section 6.1 is forward-looking. Expectations about future profitability depend on expectations regarding future patient volume and these expectations, in turn, depend on expectations regarding the determinants of the future supply and demand for hospital services. Because of data problems, one traditional way economists have dealt with the lack of direct information on the future expectations is to assume that future expectations are based on past values. For instance, expectations about future unemployment rates could be based on a weighted average of the three most recent years of unemployment rate data.

In this report, rather than use the traditional way of handling expectations, it is assumed that the hospital decision-makers had good guesses of the actual values that affect future supply and demand for hospital services. Thus, rather than rely on past values of

most variables, the 1988 values of variables are used. That is, 1988 is the baseline year for the model. A baseline year is necessary because, for the hospitals which remained open, there are many years from which to choose variables that could be the basis of future expectations. For hospitals which closed between 1985 and 1989, only variables defined at the market level are available for 1988. Therefore, for closed hospitals, variables measured at the hospital level (for example, the number of beds) are based on the year prior to closure or, if not available, the best available prior data.

6.3 Variable Definitions

The definitions of the variables used to represent the exogenous factors that affect hospital revenue and costs is the subject of this section. Briefly, variables that increase the demand for hospital services and/or revenue per admission, ceteris paribus, should decrease the probability of a hospital closing. Similarly, variables that increase the average cost of providing care, ceteris paribus, should increase the probability of a hospital closing. The individual variables used in the regressions, their data source, and expected algebraic sign are listed in Table 6-1.

Markets with increasing population will have increasing demand for hospital services, which, in turn, show lower the probability of a hospital closing. The percentage of the population that is white may have an impact. Because blacks another ethnic and racial minority groups suffer from discrimination in educational and job opportunities, the white population has better financial resources to obtain medical care. Higher per capita income is associated with a higher demand for hospital services. Therefore, hospitals located in markets with higher per capita income should be less likely to close (Table 6-1). High unemployment rates imply a lower demand for hospital services and thus increases the probability that a hospital will close. Similarly, increases in the unemployment rate decrease the demand for hospital services and thus increases the probability of a closing.

Higher educational attainment is often associated with healthier life styles which may reflect a more efficient production of health. On the other hand, persons with a higher educational attainment may be more aware of the availability of health services or more

TABLE 6-1

INDEPENDENT VARIABLE DEFINITIONS, DATA SOURCES, AND EXPECTED REGRESSION SIGN

Variable	Source	Expected Sign
Percentage population growth	ARF	-
Percentage population that is white	ARF	-
Per capita income	ARF	-
Unemployment rate	ARF	+
Percentage change of the unemployment rate	ARF	+
Median years of schooling	ARF	?
Physician-population ratio	ARF	?
Rural hospital	HCFA	+
Sole community hospital	HCFA	-
Teaching hospital - "other"	HCFA	-
Medicare case mix index	MEDPAR	?
PPS area wage index	HCFA	?
Beds: < 50	AHA	+
Beds: 50 - 99	AHA	+
Beds: 100 - 199	AHA	+
Beds: 200 +	AHA	omitted
Proprietary	AHA	omitted
Public (state and local government owned)	AHA	?
Voluntary (private not-for-profit)	AHA	?
Member of hospital chain or system	AHA	-
Financial leverage ratio (long-term debt divided by total net assets)	MCR	+
Percentage change in total inpatient days	MCR	-
Medicare's share of inpatient discharges	MCR	?
Medicaid's share of inpatient discharges	MCR	+
PPS waiver state	HCFA	?
Herfindahl index	HER	-
Total population	ARF	?
Northeast census region	MCR	?
North Central census region	MCR	?
West census region	MCR	?
South census region	MCR	omitted

Notes: ARF: Area Resource File
HCFA: HCFA's Impact File
MEDPAR: HCFA's MEDPAR File
MCR: Medicare Cost Reports
AHA: American Hospital Association's Annual Survey of Hospitals
HER: Health Economics Research, Inc.
omitted: category included in the intercept (constant) term of regression.

willing to use health services than less educated persons. Thus it is not clear what the net impact of higher area educational attainment may have on the demand for hospital services. There is a similar problem about the net effect of high physician population ratios. More physicians usually results in more provision of all health services. However, a high ratio may imply a greater willingness to treat the patient in an ambulatory setting, especially since PPS went into effect. Because these two variables were never statistically significant and since they were highly correlated with the other independent variables, they were dropped from the final regression specifications.

The next set of variables represent PPS payment adjustment factors. Pope and Adamache (1990) found that the construction of the PPS area wage index reflects the occupational mix of hospitals and thus, other things equal, tends to pay rural hospitals less than urban hospitals. Therefore, hospitals located in rural areas are expected to be more likely to close. (However, the 1989 Omnibus Budget Reconciliation Act requires that the base urban-rural labor payment differential be eliminated by fiscal year 1995.) Sole community hospitals and rural referral centers are special designations for qualifying rural hospitals. Hospitals with such designations are more favorably treated under the PPS payment mechanism and should therefore be less likely to close. The indirect medical education (IME) adjustment increases payments to teaching hospitals; the IME relies on the ratio of interns and residents per bed. The categories "other teaching" and "major teaching" in Table 4-1 are derived from the ratio of interns and residents to beds. (The rural referral center and "major teaching" hospital variables are not regressors in the probit regressions because there were not any hospitals that closed that had such designations; in order to execute, probit regressions need at least one closure in each category.)

One PPS payment adjustor variable is the Medicare case mix index which proxies the DRG payment index. Higher index values are associated with higher PPS payments. However, higher case mix values are also associated with more costly cases. Therefore, a priori, the net impact of the Medicare case mix index on hospital closures is ambiguous. Hospitals located in high labor cost areas, ceteris paribus, have higher average costs which should increase the likelihood of closure. However, hospitals in higher labor cost areas receive higher PPS payments, therefore the net impact of the PPS area wage index on the likelihood of closure is ambiguous.

Hospitals with fewer inpatient beds are expected to be more costly per admission than larger hospitals because of economies of scale. Therefore, ceteris paribus, smaller hospitals are more likely than larger hospitals to close. Hospitals that are members of hospital chains or systems are able to purchase supplies and/or obtain better financing rates than comparable hospitals that are not members of chains. Hence, hospitals which belong to chains are likely to have lower average costs and therefore are less likely to close. It is possible that hospitals which are members of chains were able to become members because they had a lower probability of closing. Thus, there could be an endogeneity problem with regard to the variable representing membership in a chain. Conversely, hospital chains sometimes acquire (accept) less profitable hospitals in order to sustain the hospital's operations.

Hospital ownership may also affect the probability of closure. First, private not-for-profit (voluntary) hospitals and publicly owned hospitals might have a lower target profit rate, Π, than proprietary hospitals (the omitted category in the regressions). Second, voluntary hospitals and public hospitals are more likely to be the recipients of gifts the community and grants from local government than proprietary hospitals. (Becker and Sloan, 1985 and other investigators have found evidence that proprietary hospitals are not less costly than voluntary or public hospitals). Therefore, it is expected that voluntary and public hospitals are less likely to close than proprietary hospitals.

Hospitals with higher degrees of financial leverage, as measured by the ratio of long-term debt to total net assets, are expected to be at greater risk of closure. Relatively high degrees of financial leverage are usually due to recently completed large scale construction (or renovation) and the reliance on long-term loans to cover successive operating losses. While some new construction may be ill-advised, it is more likely that successive operating losses is major reason for high degrees of financial leverage.

Hospitals which experienced increases in the number of total inpatient days, because of economies of scale, move down the average cost curve such that their average cost declines. Conversely, hospitals which experienced decreases in the number of total inpatient days will have higher average costs. Therefore, hospitals that the highest percentage increases in the

total number of inpatient days are less likely to close. The percentage change in total inpatient days, however, is an endogenous variable. Thus, it is used in only one regression specification. The reason for using this endogenous variable as a regressor is to directly test the notion that hospitals with the largest loss of patient volume are most likely to close.

The impact of publicly financed patients on the likelihood of closure is measured by two variables. The first is the hospital's percentage of Medicare discharges. The expected impact of a high share of Medicare discharges is ambiguous. On average, the federal government pays its share of total hospital costs that result from serving Medicare beneficiaries. In addition, the reimbursement of capital costs during this period was based on each hospital's capital costs and Medicare's share of total volume. Also, while a high Medicare share is indicative of higher average costs, the PPS reimbursement mechanism should compensate for it. The second variable is the hospital's percentage of Medicaid discharges. It is well known that Medicaid tends to underpay for the resources it consumes. Therefore, it is expected that a higher percentage of Medicaid discharges increases the likelihood of closure.

The effect of a state (Maryland, Massachusetts, New Jersey, and New York) initially receiving a PPS waiver on hospital closures is not clear. Hospitals in states receiving a PPS waiver were not subject to the PPS fixed prospective payment and its incentives to reduce costs. On the other hand, these states all had their own prospective payment programs (usually per diem) which is indicative of cost inflation problems. Because of these cost inflation problems, some of these states may have been less willing to assist financially distressed hospitals.

The Herfindahl index measures the degree of competitiveness of a market. The highest value, one, indicates a hospital monopoly. The lowest value, which approaches zero, indicates more competitive markets. It is expected that hospitals with monopolies are less likely to close than in more competitive areas.

Other variables included as regressors include the market's total population and three binary variables representing the northeast, north central, and west census regions (the south is the omitted category). Means of the independent variables are presented in Table 6-2. In addition, the variable acronyms are included in Table 6-2.

TABLE 6-2

INDEPENDENT VARIABLE MEANS

Variable	Description	Mean	Standard Deviation
BEDS1	Beds: < 50	0.312	0.463
BEDS2	Beds: 50 - 99	0.229	0.420
BEDS3	Beds: 100 - 199	0.201	0.401
CHAIN	Member of hospital chain or system	0.376	0.484
PUBLIC	Public (state and local government owned)	0.291	0.454
VOLUN	Voluntary (private not-for-profit)	0.566	0.496
TOTPOP	Total population (millions), 1988	1.004	1.912
PCINC	Per capita income (thousands), 1988	14.744	3.464
UERATE	Unemployment rate, 1988	6.283	2.866
WINDEX	PPS area wage index, 1988	0.905	0.161
PGR8088	Percentage population growth, 1980-88	6.426	11.619
WHPCT84	Percentage population that is white, 1984	87.890	12.364
CUER8588	Percentage change of the unemployment rate, 1985-88	-16.973	15.638
HERFNX84	Herfindahl index, 1984	0.450	0.372
WAIVERED	PPS waiver state	0.067	0.250
RURAL	Rural hospital	0.498	0.500
NEAST	Northeast census region	0.135	0.341
NCENT	North Central census region	0.304	0.460
WEST	West census region	0.175	0.380
SCH	Sole community hospital	0.063	0.242
TCHOTH	Teaching hospital - other	0.142	0.349
NONTCH	Non-teaching hospital	0.828	0.378
LEV	Financial leverage ratio	0.345	0.370
CMI	Medicare case mix index	1.160	0.161
PCTMCRDC	Medicare's share of inpatient discharges	38.932	13.466
PCTMCDDC	Medicaid's share of inpatient discharges	11.283	9.872
PCTIPD	Percentage change in total inpatient days	-3.890	19.955

Note: Values for hospital-specific characteristics depends on whether hospital closed or remained open. For hospitals which closed, the values are from the year prior to closure (or the best available before the year of closure). For hospitals which remained open, 1988 values are used.

The independent variables are classified as being primarily influencing supply (costs) or demand (revenue adjustment). The independent variables can also be classified by the level by which they are measured: hospital-specific or market level. In this chapter, nine of the independent variables are considered to primarily affect of hospital supply or cost: BEDS1, BEDS2, BEDS3, CHAIN, LEV, CMI, PCTMCRDC, PCTMCDDC, and WINDEX. Of these nine variables, only WINDEX is measured at the market level. Eleven of the independent variables are considered to primarily affect demand or revenue adjustment: PUBLIC, VOLUN, SCH, TCHOTH, NONTCH (hospital-specific) and PCINC, UERATE, PGR8088, WHPCT84, CUER8588, RURAL (market level). Some of the variables classified as primarily affecting costs also affect revenues - for example, the PPS area wage index (WINDEX). While it is somewhat arbitrary to classify the PPS area wage index as primarily affecting costs instead of revenues, the reason the PPS wage index is used to adjust PPS payments is because wage rates geographically vary. And, for the most part, local wage rates are not controlled by individual hospitals. Conversely, some of the variables classified as primarily affecting demand or revenue adjustment also affect costs. The Herfindahl index is a measure of market competition. No attempt was made to force it into one of the categories of supply or demand (arguments for each can be made).

6.4 Probit Regression Results

The probit regression results are presented in Tables 6-3 and 6-4. The inclusion of the percentage change in total inpatient days (PCTIPD) as a regressor in the second regression (Table 6-4) is the difference between the two regressions (item nonresponse on the components of PCTIPD is responsible for the loss of 56 observations -- 10 closed hospitals and 46 open hospitals). The chi-squared statistic for each regression indicates that both regressions are statistically significant. However, each has a pseudo R^2 of only .12* which indicates that

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*Unlike OLS, there is no measure of R^2 for probit or logit regressions; however, several "pseudo" measures have been suggested in the literature. The values of the text are calculated: chi-square/(N + chi-square) where chi-square is the regression chi-square and N is the total number of observations (Aldrich and Nelson, 1984, p.57).

TABLE 6-3

HOSPITAL CLOSURE REGRESION 1985-89 (BASIC PROBIT RESULTS)

MAXIMUM LIKELIHOOD ESTIMATES

Total observations	4,959
Number of closed hospitals..	279
Log-Likelihood.....	-722.6
Restricted (Slopes=0) Log-L.	-1073.6
Chi-Squared (26).....	702.59***
Significance Level.....	.00
Pseudo R Square.....	.12

Variable	Coefficient	Std. Error	T-ratio	Prob|t|>X	Derivative[a]
CONSTANT	3.434***	0.854	4.019	0.000	10.366%
BEDS1	0.936***	0.193	4.849	0.000	4.660
BEDS2	0.593***	0.184	3.215	0.001	2.672
BEDS3	0.384**	0.179	2.151	0.031	1.530
CHAIN	-1.225***	0.118	-10.370	0.000	-3.381
PUBLIC	-0.978***	0.122	-8.038	0.000	-2.192
VOLUN	-0.615***	0.108	-5.679	0.000	-2.162
TOTPOP	0.049	0.031	1.592	0.111	0.148
PCINC	0.021	0.022	0.963	0.335	0.063
UERATE	0.014	0.016	0.877	0.380	0.042
WINDEX	-1.053*	0.632	-1.666	0.096	-3.178
PGR8088	-0.011**	0.004	-2.547	0.011	-0.034
WHPCT84	0.000	0.003	-0.016	0.987	0.000
CUER8588	0.003	0.003	1.146	0.252	0.009
HERFNX84	-0.841***	0.173	-4.873	0.000	-2.539
WAIVERED	0.246	0.227	1.088	0.277	0.951
RURAL	-0.036	0.149	-0.239	0.811	-0.107
NEAST	-0.342	0.214	-1.595	0.111	-0.788
NCENT	-0.066	0.111	-0.596	0.551	-0.194
WEST	0.219	0.155	1.410	0.159	0.779
SCH	-0.475**	0.193	-2.455	0.014	-0.917
TCHOTH	0.451	0.412	1.095	0.274	1.997
NONTCH	0.230	0.403	0.572	0.567	0.590
LEV	0.528***	0.095	5.568	0.000	1.594
CMI	-3.789***	0.370	-10.230	0.000	-11.438
PCTMCRDC	-0.003	0.003	-1.137	0.255	-0.009
PCTMCDDC	0.003	0.004	0.974	0.330	0.011

*Statistically significant at ten percent level.
**Statistically significant at five percent level.
***Statistically significant at one percent level.

[a]Converted to percentages.

TABLE 6-4

HOSPITAL CLOSURE REGRESSION, 1985-89 (VARIANT OF BASIC PROBIT RESULTS)

MAXIMUM LIKELIHOOD ESTIMATES

Total observations	4,901
Number of closed hospitals..	265
Log-Likelihood.....	-695.21
Restricted (Slopes=0) Log-L.	-1030.8
Chi-Squared (27).....	671.24***
Significance Level.....	.00
Pseudo R-square.....	.12

Variable	Coefficient	Std. Error	T-ratio	Prob|t|>X	Derivative[a]
CONSTANT	3.272***	0.916	3.571	0.000	9.443%
BEDS1	0.902***	0.198	4.558	0.000	4.247
BEDS2	0.596***	0.188	3.162	0.002	2.580
BEDS3	0.368**	0.183	2.013	0.044	1.387
CHAIN	-1.214***	0.120	-10.079	0.000	-3.215
PUBLIC	-0.947***	0.124	-7.653	0.000	-2.042
VOLUN	-0.601***	0.111	-5.429	0.000	-2.015
TOTPOP	0.061*	0.032	1.909	0.056	0.176
PCINC	0.016	0.022	0.724	0.469	0.047
UERATE	0.011	0.016	0.704	0.481	0.033
WINDEX	-1.260*	0.654	-1.926	0.054	-3.634
PGR8088	-0.011**	0.005	-2.373	0.018	-0.032
WHPCT84	-0.001	0.003	-0.198	0.843	-0.002
CUER8588	0.003	0.003	1.201	0.230	0.009
HERFNX84	-0.882***	0.176	-5.026	0.000	-2.545
WAIVERED	0.218	0.228	0.953	0.340	0.783
RURAL	-0.019	0.151	-0.123	0.902	-0.054
NEAST	-0.269	0.216	-1.245	0.213	-0.626
NCENT	-0.050	0.113	-0.445	0.656	-0.142
WEST	0.231	0.159	1.451	0.147	0.795
SCH	-0.408**	0.194	-2.105	0.035	-0.796
TCHOTH	0.797	0.516	1.545	0.122	4.578
NONTCH	0.568	0.510	1.115	0.265	1.124
LEV	0.501***	0.098	5.125	0.000	1.444
CMI	-3.663***	0.383	-9.576	0.000	-10.570
PCTMCRDC	-0.004	0.003	-1.387	0.166	-0.011
PCTMCDDC	0.002	0.004	0.639	0.523	0.007
PCTIPD	-0.005***	0.001	-3.946	0.000	-0.015

*Statistically significant at ten percent level.
**Statistically significant at five percent level.
***Statistically significant at one percent level.

[a]Converted to percentages.

either there is a large random element in hospital closures or, more likely, that the regression omits important (but unavailable) variables representing factors important in explaining hospital closures (discussed later). Unlike OLS coefficients, probit regression coefficients do not directly measure the partial derivative of an independent variable on the probability of a closure. Rather, probit regression coefficients need to be converted (c.f., Amemiya, 1981, p. 1488). The final column in Tables 6-3 and 6-4 contain the partial derivatives of a small change in the value of an independent variable on the probability of a hospital closure (where probability is measured from zero to 100 percent).

Of the 26 independent variables in Table 6-3,** eleven primarily represent the demand for hospital services or PPS revenue adjustment indicators while nine primarily represent cost factors and the last six represent other control factors. Five of the demand/revenue variables are statistically significant while six of the cost variables are statistically significant. Of the eleven demand/revenue variables, five are measured at the hospital level while the rest are measured at the market level. Of the five demand/revenue variables measured at the hospital level, three have statistically significant regression coefficients: PUBLIC, VOLUN, and SCH. All three have negative signs which indicates a lower probability of closure. A publicly owned hospital (PUBLIC) has a 2.2 percent lower probability of closure than a proprietary hospital.*** A private not-for-profit hospital (VOLUN) has a 2.2 percent lower probability of being closed than a proprietary hospital. Hospitals which have the sole community (SCH) status designation (available only to rural hospitals) have a .9 percent lower likelihood of closing.

One of the six demand/revenue factors measured at the market level has a statistically significant regression coefficients. A one percentage point higher population growth rate (PGR8088) is associated with a .03 percent lower probability of a hospital closing in the market.

Of the cost variables, only one was measured at the market level, the PPS area wage index (WINDEX). It has a statistically significant negative regression coefficient. Of the other

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**Except where indicated, the discussion of results is based on Table 6-3.

***Approximately 5.6 percent of the observations represented closed hospitals. Thus, the probability of a public hospital closing is 3.4 percent (=5.6-2.2).

eight cost variables, which are measured at the hospital level, only two do not have statistically significant regression coefficients. They are the percentage of hospital discharges that are Medicare beneficiaries (PCTMCRDC) and Medicaid eligibles (PCTMCDDC). It was noted in the previous section that Medicare, for the nation as a whole, is supposed to pay its share of hospital costs. The regression results indicate that a hospital's Medicare caseload is not a factor associated with hospital closures. Somewhat more surprising is the result that the Medicaid share does not have an effect on closure. Part of the reason may be due to the disproportionate share reimbursement adjustment by Medicare which formally started in May 1986 and which was informally part of the PPS indirect teaching adjustment (CBO, 1990).

Smaller hospitals are at greater risk of closing than hospitals of more than 200 beds. The regression results also indicate that the bedsize group of less than 50 beds is at greatest risk of closing with a 4.7 percent higher probability of closing than hospitals with more than 200 beds. The next most vulnerable bedsize group is the 50-99 group which has a 2.7 percent higher probability of closure and the 100-199 group has about a 1.5 percent higher probability of closure relative to hospitals with 200 or more beds. These results indicate that in a period characterized by tighter reimbursement rules and rates that the smallest hospitals have the least ability to keep average costs low (or lower).

The Medicare case mix index (CMI) has a negative sign which indicates that hospitals which treat a more complex mix of diagnoses have a lower probability of closing despite the higher costs associated with treating such patients. As discussed in the previous section, Medicare compensates, through the DRG payment mechanism, hospitals for treating more complex diagnoses; however, the payment mechanism does not adjust for intraclass differences in complexity. In addition, the CMI may be a proxy for the attractiveness (e.g., reputation or facilities) of the hospital relative to other local hospitals. For instance, there is no variable specifically measuring the relative attractiveness of a hospital with regard to its competitors. The CMI might be correlated with such an omitted variable. Because there are other variables which the CMI are correlated with, such as the teaching variables, alternative regression specifications were tried. Dropping CMI did not affect the statistical significance of the teaching variables nor did the dropping of the teaching variables affect the statistical significance of CMI or any other variable.

Affiliation with a hospital system (chain) is associated with a 3.4 percent lower probability of closure. Hospitals which have a high degree of financial leverage (LEV), as measured by the ratio of long-term debt to total net assets, have a 1.6 percent higher probability of closure.

Hospitals located in less competitive markets (CHERFNX84) have a lower probability of closing than hospitals located in more competitive markets. Hospitals in less competitive markets do not, ceteris paribus, need to engage in technological "arms races." Nor do they need worry as much about recalcitrant physicians taking their patients to other hospitals.

The inclusion of the percentage change of inpatient days (PCTIPD) in Table 6-4 did not affect statistical significance of the individual variables discussed thus far. Hospitals which experienced relatively larger declines of inpatient days were more likely to close; PCTIPD, however, is endogenous. A one percentage point decline in inpatient days increases the likelihood of closure by .015 percent. A ten percentage point decline in inpatients days (which is equal to one-half of the standard deviation of PCTIPD) would result in a .15 percent increase in the likelihood of closure.* This result suggests that a multiequation closure model should be considered with one of the equations explaining the decline in inpatient days. Although the regression coefficient for the decline of inpatient days has a high degree of statistical significance, its magnitude is small. This suggests that despite large declines of inpatient volumes, many hospitals continue to provide care instead of closing. Thus, the magnitude of the regression coefficient may be understated. The question then arises about why hospitals hang on. One possible reason is that most hospitals are either public or private not-for-profit hospitals that do not have stockholders to satisfy - stockholders that could force a proprietary hospital to close under similar circumstances.

While many of the results of the multivariate analysis presented in this report are similar to those presented in a GAO report (June 1990, p. 26), there are some important differences. In particular, the results in Table 6-3 indicated that Medicare and Medicaid shares

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*This second calculation is a rough approximation since linear extrapolations of probit derivatives are less accurate than similar extrapolations used OLS regressions; this is due to the nonlinearity of the probit model.

did not have an effect on the likelihood of closure. This finding is in conflict with the findings of the GAO report which found that Medicare and Medicaid shares of inpatient days affected closure: a low Medicare share increased the probability of closure and a high Medicaid share increased the likelihood of closure. The reason(s) for the discrepancies is (are) not immediately apparent. One possibility is that the GAO supplemented missing Medicare Cost Report data with AHA data. This supplement yielded data for 31 more closed hospitals (14 percent) for the 1985-8 sub-sample than was available to CHER. The variables representing the Medicare and Medicaid shares in the GAO report were categorical instead of continuous variables. The GAO's criteria for choosing the demarcations of the categorical variables were not stated.

An attempt was made to replicate GAO's results using categorical variables to represent Medicare and Medicaid shares of discharges. A Medicaid binary variable was created using the 14.9 percent share (75th percentile) as a boundary. Several Medicare binary variables were created using different percentile levels to demarcate the categories. The Medicaid binary variable was not statistically significant. The only combination of Medicare binary variables that produced statistically significant results was to have two binary variables: low Medicare share and very high Medicare share. The low Medicare share binary variable was set to 1 if the Medicare share was less than 37.8 percent (50th percentile) and 0 otherwise. The very high Medicare share binary variable was set to 1 if the Medicare share was greater than or equal to 61.8 percent (95th percentile) and 0 otherwise. (The reference group was Medicare share between the 50th and 95th percentiles.) Unlike the GAO, this specification produced the result that a very high Medicare share (instead of a low Medicare share) increased the probability of closure. This specification was done on both the 1985-89 and the 1985-88 sets of hospital closures and had the same results for both periods. While this finding that a very high Medicare share of discharges increases the likelihood of closure, it was only obtained by repeated re-specification of the binary variables. Further, the high Medicare share binary variable represents only five percent of hospitals with the highest

shares - a group that is probably too narrowly defined.* Thus, the basic results presented in Table 6-3 are the preferred results.**

Another possible problem with the GAO's specification is the use of an endogenous variable, occupancy rate, as a regressor in its logit regression. Another difference between the GAO and this report is that the GAO used 1985 or earlier data for most of its variables whereas this report used 1988 data except for individual characteristics of closed hospitals. The specifications in Tables 6-3 and 6-4 of this report were re-estimated using 1984 baseline data; the results, however, were virtually the same as using the 1988 baseline data.

Since the GAO study did not report regression statistics such as the pseudo R^2 nor the chi-squared statistic for the entire logit, it is difficult to assess the GAO's overall results. However, it is quite possible that the pseudo R^2 of the GAO's logit regression is as low as the .12 reported in Tables 6-3 and 6-4 of this report. This leads to questions regarding the viability of the underlying theoretical models (none was set forth by the GAO), the data used, or the variables used to test the models.

6.5 Summary

This chapter proposed a simple hospital closure model which posited that hospitals which did not expect to meet a future minimum financial target would close. The data used to test the model consisted of hospitals which closed between 1985 and 1989 (inclusive) and hospitals which remained open from 1980 through 1989. A multivariate probit regression was used to test the model.

The main results are as follows. Smaller hospitals are more likely to close than larger hospitals. Public and private not-for-profit hospitals are less likely to close than proprietary hospitals. Hospitals affiliated with hospital systems (chains) are less likely to close. Hospitals

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*The direction of causality might be in the opposite direction for the very high Medicare share group: hospitals which take a long time to close may be losing a higher percentage of their non-Medicare patients to other hospitals so that a very high Medicare share is a result of closing instead of a determinant of closing.

**Note, however, on page 20, the GAO report stated, "We found that the risk of closure for hospitals with a relatively small percentage of Medicare days (fewer than 36 percent) was sensitive to the data source or the number of observations in the model. As such, this finding should be interpreted cautiously."

with a high degree of financial leverage are more likely to close. The shares of inpatient discharges covered by Medicare or Medicaid does not affect the likelihood of closure.

The last mentioned results are in conflict with the findings contained in a GAO report which found that Medicare and Medicaid shares of inpatient days affected closure: a low Medicare share increased the probability of closure and a high Medicaid share increased the likelihood of closure. One possible problem with the GAO's specification is the use of an endogenous variable, occupancy rate, as a regressor in its logit regression.

Most of the results of the multivariate analysis supports the findings of the descriptive analyses in Chapters 4 and 5. However, there are two notable differences. The descriptive analysis in Chapter 4 indicated that rural hospitals were slightly more likely to close than urban hospitals and that hospitals with high shares of Medicaid admissions were more at risk of closure than hospitals with lower Medicaid shares. The multivariate analysis indicates that a hospital in a rural area, ceteris paribus, is no more likely to close than an urban hospital. The reason why the rural binary variable is not statistically significant is likely due to the controls for bedsize: smaller hospitals are more likely to close and most small hospitals are in rural areas. The multivariate analysis also indicates that the share of Medicaid admissions does not affect the likelihood of closure.

One problem with the data is inescapable: there were relatively few hospital closures as compared to the overall population of hospitals between 1985 and 1989. Only with more years of data can definite conclusions about the results be established. Some factors that may affect a hospital's likelihood of closure may be difficult, if not impossible, to measure or obtain. For instance, during recent site visits conducted by CHER (funded by HCFA) at hospitals that experienced a merger during the mid-1980s, it was found that one hospital was put at risk of closing because its medical staff had successfully resisted extension of admitting privileges to new physicians which in turn reduced the acquisition of new technology and a more timely renovation of the facility (the facility was eventually closed). Measuring the attitudes of staff physicians even through proxies such as average age is virtually impossible.

Other factors which could affect the probability of closure include the average age of the facility, the proximity of competing hospitals (especially in urban areas), and the relative attractiveness of competing hospitals. Some of these variables are also difficult to obtain or construct. For instance, CHER found that poor depreciation and balance sheet data made it difficult to construct measures of the average age of assets of a hospital. In particular, a large number of observations were lost during such an attempt - a larger number than an analysis of hospital closures can sustain.

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APPENDIX A

1989 HOSPITAL CLOSURES

APPENDIX A

1989 HOSPITAL CLOSURES

AHA ID	Name
110565	VAN BUREN COMMUNITY HOSPITAL
119010	TAYLOR HOSPITAL
140785	SANCTA MARIA HOSPITAL
210090	ARNOLD GREGORY MEM HOSPITAL
211750	EMMA LAING STEVENS HOSPITAL
214660	COMMUNITY HOSPITAL
221040	ST MARY'S HOSPITAL
233281	FRANKLIN MATERNITY HOSPITAL
320430	PARKWOOD HOSPITAL
350575	WYOMING GENERAL HOSPITAL
361263	ROBERSONVILLE COMM HOSPITAL
370235	SOUTHLAND MEDICAL CENTER
399160	AMI SOUTHEASTERN MEDICAL CTR
412316	WELLINGTON COMMUNITY HOSPITAL
420167	GEORGE ADE MEMORIAL HOSPITAL
430445	MT SINAI HOSPITAL NORTH
431520	GATEWAY COMMUNITY HOSPITAL
431575	PEARCE HOSPITAL
439055	LA HARPE HOSPITAL
440795	REDFORD COMMUNITY HOSPITAL
540334	SOUTH WASHINGTON COUNTY HOSP
540440	SOUTH MISSISSIPPI STATE HOSP
540560	MATTY HERSEE HOSPITAL
540860	KUHN MEMORIAL STATE HOSPITAL
549140	WEST SCOTT BAPTIST HOSPITAL
610220	CALEDONIA HEALTH CARE CENTER
610525	GAYLORD COMMUNITY HOSPITAL
612095	ST MARY'S HOSPITAL AND HOME
650225	KINGSBURY COUNTY MEM HOSPITAL
660123	COMMUNITY MEMORIAL HOSPITAL
660786	FRITZER MEMORIAL HOSPITAL
660975	WAKEFIELD HEALTHCARE CENTER
670096	CANEY MUNICIPAL HOSPITAL
670960	MEMORIAL HOSPITAL OF TOPEKA
710030	GRAY'S HOSPITAL
710650	CENTRAL OZARKS MEDICAL CENTER
720627	MONTELEPRE MEMORIAL HOSPITAL
731177	CITY OF FAITH HOSPITAL
739100	MOOTS OSTEOPATHIC HOSPITAL
740104	SOUTH PLAINS HOSPITAL CLINIC
740123	ARCHER COUNTY HOSPITAL
740355	HALL-BENNETT MEMORIAL HOSPITAL
740540	ST EDWARD HOSPITAL
741617	VENCARE HOSPITAL NORTH DALLAS
741618	MAURITZ MEMORIAL HOSPITAL

APPENDIX A

1989 HOSPITAL CLOSURES
(continued)

742507	MENARD HOSPITAL
742640	NEWTON COUNTY MEM HOSPITAL
743155	SAN SABA HOSPITAL
743335	STERLING COUNTY HOSPITAL
840205	DOCTORS HOSPITAL MEDICAL CTR
840210	UNION PRINTERS HOME
84037A	ROCKY MOUNTAIN HOSPITAL
840790	MONTE VISTA COMMUNITY HOSPITAL
849220	WALSH DISTRICT HOSPITAL
869100	BAPTIST MED CTR-SCOTTSDALE (on IG's list as Scottsdale Community Hospital)
910670	MEDICAL DENTAL HOSPITAL
920335	MALHEUR MEMORIAL HOSP DISTRICT
920820	HARVEY E RINEHART MEM HOSPITAL
932255	CHANNEL ISLANDS COMM HOSPITAL
933259	ESTUDILLO HOSPITAL
933935	ST JUDE HOSPITAL YORBA LINDA

APPENDIX B

1989 HOSPITAL CLOSURES

Differences between CHER and IG

APPENDIX B

1989 HOSPITAL CLOSURES

Differences Between CHER and IG

There are a large number of differences between the Inspector General's (IG) list of short-term acute-care hospitals that closed in 1989 and CHER's list. The purpose of this appendix is to indicate the reasons for the differences. The first part of this appendix lists those hospitals the IG shows as closing in 1989 and the reason(s) why CHER did not include them in our list. The second part of this appendix lists those hospitals that CHER shows as closing in 1989 and possible reasons why the IG did not include them in the IG report. Unless otherwise noted, all hospital IDs are AHA IDs.

B.1 Hospitals on IG's List of Closures but not on CHER's List

1. *Wheeler Hospital, Gilroy, CA (ID=930830).*

   According to the hospital's administration, there was an ownership and name change in July 1989. There was, however, no disruption of care. It is possible that the old license was surrendered and a new license issued to the new owner.

2. *AMC Cancer Research Center, Lakewood, CO (ID=840910).*

   This facility did, in fact, close in 1989. However, according to AHA information, it only had three staffed beds. Because it had so few beds and because of its apparent limited scope of services, it does not qualify as a general acute care hospital and thus is not included in CHER's count.

3. *Lutheran General Hospital, Park Ridge, IL.*

   In the first instance, the IG did not provide sufficiently detailed information on the facility that closed. The site that closed was the old Augustana Hospital (located in the Lincoln Park section of Chicago) which Lutheran General Hospital acquired in 1983.

   As noted in Chapter 2 of the report, CHER does not include in its count of closures those sites that closed and is part of a larger hospital organization still in operation and which does not have its own AHA hospital ID. Augustana's AHA ID prior to the merger was 430410.

4. *St. Joseph's Hospital, Alton, IL (ID=430040).*

   In September 1989, St. Joseph's was acquired by St. Anthony's. Subsequent to the merger, St. Joseph's (subsequently renamed St. Clare's) was converted from general acute care to psychiatric and other chemical dependency care. As noted in Chapter 2 of the report, CHER maintains changes of service from general acute care to other hospital care as a category distinct from closures.

5. *Sheridan Road Hospital, Chicago, IL.*

   Sheridan Road Hospital was owned by Rush Presbyterian St. Luke's. Because Sheridan did not have its own AHA ID and was part of a larger hospital organization still providing general acute care services, it was not included in CHER's closures count.

APPENDIX B

1989 HOSPITAL CLOSURES DIFFERENCES
(continued)

6. *Kingwood Hospital, Michigan City, IN (ID=421010).*

   Change of service from general acute care to psychiatric care only. CHER maintains change of service as a separate category.

7. *Our Lady of Lourdes of St. Martinsville, St. Martinsville, LA.*

   The parent organization (Our Lady of Lourdes) located in Lafayette took over the St. Martinsville site in 1982 and terminated general acute care inpatient services at that time. Since 1982, the St. Martinsville facility provided ambulatory services only. Therefore, the St. Martinsville site, when it closed in 1989, no longer qualified as a hospital. It is possible that the hospital license was surrendered in 1989 instead of 1982.

8. *Choate Hospital, Woburn, MA (ID=142300).*

   Choate merged with Symmes in 1981. According to Massachusetts state licensing board officials, the Choate facility was in closed in 1990 instead of 1989.

9. *Thorn Hospital, Hudson, MI (ID=441400).*

   Thorn Hospital closed in 1989 but subsequently re-opened in 1990. When CHER knows that a hospital has re-opened, it does not include the initial closure in its count of closures.

10. *Mackinac Straits Hospital & Health Ctr., St. Ignace, MI (ID= 442305).*

    The hospital closed in 1989 but subsequently re-opened in 1990. When CHER knows that a hospital has re-opened, it does not include the initial closure in its count of closures.

11. *Russell Memorial Hospital, Onaway, MI (ID=441993).*

    Russell ceased admitting patients in 1988; it surrendered its license in 1989.

12. *Physicians Hospital, Meridian, MS (ID=540590).*

    Physicians' "closed" one day and re-opened the following day as Laurelwood Center. While there was a change in ownership, there was no change in service and, according to a hospital administrator, there was no disruption of care.

13. *St. John's Health & Hospital Ctr., Pittsburgh, PA (ID=232590).*

    St. John's changed from general acute care to psychiatric only. CHER maintains change of service as a separate category.

14. *Notre Dame Hospital, Central Falls, RI (ID=150010).*

    Notre Dame was part of a merger in 1989. After the merger, it was changed to providing ambulatory care only. As previously noted, CHER does not count closures subsequent to mergers.

APPENDIX B

1989 HOSPITAL CLOSURES DIFFERENCES
(continued)

15. *Laurens District Hosp. (ID=370440) and Bailey Memorial Hosp. (ID=370120).*

These two hospitals merged in 1982. In 1989 they closed the old facilities and commenced operations in a new facility. There was no dis-continuity of care. Because a replacement facility is providing service, CHER is not including the closures of the old facilities in its count.

16. *Northwest General Hospital, Knoxville, TN (ID=529087).*

On January 8, 1990, Northwest General became Oakwood Medical Center. While still a hospital, Oakwood no longer provides general acute care services. CHER maintains change of service as a separate category.

17. *Seton Holy Cross, Austin, TX (ID=740180).*

Holy Cross Hospital merged with Seton Medical Center in 1984. The Holy Cross site ceased providing general acute care in 1987 and was totally closed in 1989. As noted previously, CHER does not count closures that happen subsequent to mergers. (We have other information, unverified, which suggests that a new entity started providing general acute care services at the Holy Cross site in 1990.)

18. *Leon Memorial Hospital, Buffalo, TX (ID=740501).*

Leon ceased operations in 1988; surrendered license in 1989.

19. *Pioneer Park Hospital, Irving, TX (ID=742054).*

Pioneer ceased operations in 1988; surrendered license in 1989.

20. *HCA Mansfield Hospital, Mansfield, TX (ID=742415).*

Mansfield did close in 1989 but subsequently re-opened in 1990. When CHER knows that a hospital has re-opened, it does not include the initial closure in its count of closures.

B.2 Hospitals on CHER's List of Closures but not on IG's List

1. *Franklin Maternity Hospital, Philadelphia, PA (ID=233281).*

The AHA classifies this as a hospital specializing in obstetrics and gynecology. CHER includes this type of hospital in the UNIVERSE file. The IG may have ignored it because it probably does not provide many, if any, services to Medicare beneficiaries.

2. *Wyoming General Hospital, Mullens, WV (ID=350575).*

The IG indicates this hospital closed in 1988. CHER's records indicate that the hospital re-opened and then re-closed in 1989.

3. *VENCARE Hospital North Dallas, Garland, TX (ID=741617).*

CHER's records indicate that this hospital had closed, re-opened, and then re-closed in 1989.

APPENDIX B

1989 HOSPITAL CLOSURES DIFFERENCES
(continued)

4. *Union Printers Home, CO (ID=840210).*

   Although seemingly more of a long-term care facility, the AHA classifies this hospital as a short-term general hospital.

5. *Estudillo Hospital, San Leandro, CA (ID=933259).*

   This hospital, according to the AHA, had only six beds. This hospital barely meets CHER's lower limit to qualify as a hospital; the IG may have felt that the facility was too small to count as a hospital.

6. *St. Jude Hospital - Yorba Linda, Yorba Linda, CA (ID=933935).*

   The AHA list in Burda (1991) indicates this hospital closed in 1990. The IG may also believe that this is the case.